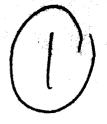
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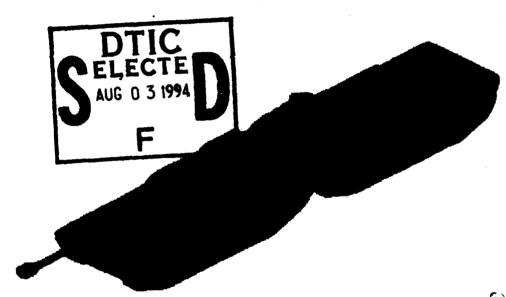


Advanced Distributed Simulation Technology

Advanced Field Artillery System (AFAS) / Future Armored Resupply Vehicle (FARV) Simulation Feasibility Analysis Study (FAS)

APPENDIX R

18 July 1994 Revision 1.0



Prepared for:

**STRICOM** 

U.S. Army Simulation, Training and Instrumentation Command 12350 Research Parkway Orlando, FL 32826-3275

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#### APPENDIX B

### FEASIBLE AREAS FOR DISTRIBUTED INTERACTIVE SIMULATION (DIS) EXPERIMENTATION

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#### **TABLE OF CONTENTS**

	APPENDIX B	3
20.	FEASIBLE AREAS FOR DISTRIBUTED INTERACTIVE	
	SIMULATION (DIS) EXPERIMENTATION	3
20.1	Assumptions	3
20.1.1	Contractor Interface	3
20.1.2	Battlefield Distributed Simulation-Developmental (BDS-D)	3
20.1.3	DIS Protocol	3
20.1.4	Requirements References	3
20.1.5	Crew Manning	3
20.2	Determine Feasible Areas for DIS Virtual Experimentation	3
20.2.1	Identification of Potential Areas for Experimentation	3
20.2.2	Analysis of Each Subject Area for Experimentation	4
20.3	Determine DIS Protocol Data Unit [PDU] Requirements	5

#### **LIST OF FIGURES**

Figure 20.2	Potential Areas for Experimentation	4
Figure 20.2.2	DIS-Ability Matrix	5
Figure 20.3	DIS PDU Requirements	6

#### LIST OF TABLES

7 Thru 28
29 Thru 39
40 Thru 49
50 Thru 54
55 Thru 58
59 Thru 61
62 Thru 68
69 Thru 71
72 Thru 75
76 Thru 90
91 Thru 94
95 Thru 101
102 Thru 103
104 Thru 121
122 Thru 124
125 Thru 126
127 Thru 129
130 Thru 132
133 Thru 136
137 Thru 139
140 Thru 141
142 Thru 143

#### ADST/WDL/TR-94-W003318

#### July 18,1994

AFAS Docking	144 Thru 148
FARV Docking	149 Thru 153
AFAS Ammunition Transfer Operations	154 Thru 161
FARV Ammunition Transfer Operations	162 Thru 171
AFAS LRP Operations	172 Thru 179
FARV LRP Operations	180 Thru 187
AFAS Degraded Operations	188 Thru 196
FARV Degraded Operations	197 Thru 204
AFAS Crew Size and Military Occupational Specialty (MOS)	205 Thru 207
FARV Crew Size and Military Occupational Specialty (MOS)	208 Thru 210
AFAS Crew MOPP Levels	211 Thru 212
FARV Crew MOPP Levels	213 Thru 214
AFAS Crew Positions	215 Thru 224
FARV Crew Positions	225 Thru 233
AFAS Environment	234 Thru 237
FARV Environment	238 Thru 241
AFAS and FARV System Safety	242 Thru 246
AFAS Mobility	247 Thru 262
FARV Mobility	263 Thru 278
AFAS Auxillary Power	279 Thru 280
FARV Auxillary Power	281 Thru 282
AFAS Interopeability	283 Thru 290
FARV Interopeability	291 Thru 298

#### **APPENDIX B**

- 20. FEASIBLE AREAS FOR DISTRIBUTED INTERACTIVE SIMULATION (DIS) EXPERIMENTATION. Providing the DEM/VAL contractor with an AFAS/FARV simulator suite is an attractive course of action for AFAS and FARV development. The simulator suite would permit the contractor to install prototype vehicle subsystems, operate the subsystems with surrogate or military crews in a combined arms environment, and exploit feedback mechanisms that provide measurable results on the subsystem's effectiveness. However, what areas are really suitable for DIS virtual experimentation and testing? What command, control, and communications (C³) organizations and capabilities are needed to drive AFAS and FARV operations to support feasible experimentation and testing? What unmanned DIS entities in the form of Semi-Automated Forces (SAFOR) are required? These are the questions that this appendix addresses.
- 20.1 Assumptions. Listed below are the general assumptions made by FAS investigators as they conducted their analyses to determine areas suitable for DIS experimentation:
- 20.1.1 Contractor Interface. The DEM/VAL contractor will ensure that equipment installed in an AFAS or FARV simulator provides the required data to the simulation software architecture to support tests/experiments involving that equipment.
- 20.1.2 Battlefield Distributed Simulation-Developmental (BDS-D). The BDS-D virtual environment will be the simulation employed to support test objectives.
  - 20.1.3 DIS Protocol. BDS-D will employ DIS Application Protocol Version
- 20.1.4 Requirements References. AFAS/FARV operational requirements, mission profiles, and specifications provide adequate information to derive simulator/simulation requirements for AFAS and FARV experimentation and testing.
- 20.1.5 Crew Manning. AFAS and FARV crew manning levels and Military Occupational Specialty (MOS) require further experimentation and analysis.
  - 20.2 Determine Feasible Areas for DIS Virtual Experimentation.
- 20.2.1 Identification of Potential Areas for Experimentation. We examined the AFAS and FARV ORDs and system specifications and identified areas for experimentation that appeared to be supportable by data captured by a virtual DIS network. We identified 20 potential "DIS-able" areas. See Figure 20.2 below

Experiment	
Number	Potential Areas for Experimentation
1	Command, Control, and Communications
2	AFAS primary armament
3	Secondary armament
4	Decision aids: RSOP, SD, FMP, SUST, MM, ET
5	Sensor assets to support SD, i.e., FLIR, video, other
6	Countermeasure suite
7	Firing/resupply position parameters
8	Ammunition capacity
9	Docking operations
10	Ammunition transfer operations
11	LRP operations
12	Degraded operations
12	Degraded Operations
13	Crew size
14	Crew MOPP levels
15	Crew position intra/intervisibility
16	Crew environment
17	System safety
18	Vehicle mobility
19	Auxilliary power
20	Interoperability

Figure 20.2 Potential Areas for Experimentation

20.2.2 Analysis of Each Subject Area for Experimentation. We analyzed the requirements and specifications in each of the 20 experimental areas using the matrix in Figure 20.2.2. Based on the typical data currently captured by the BDS-D network, established DIS protocol data units (PDUs), and other designated data that a DIS network may capture if the DEM/VAL contractor feeds the data into the simulation software architecture, we determined the DIS-ability of each specification. If our initial assessment indicated that a specification was supportable by virtual DIS experimentation, we identified measures of performance or our intent for data collection. Next, we identified the data elements necessary to support experimentation for the specification under consideration. After we completed the matrix for an experimental area, we summarized the results of our analysis. We also discussed a sample experiment and the kind of information that experiment would yield. Finally, we addressed resource requirements to support testing for the experimental area under examination. We addressed the number and type of simulators needed, SAFOR requirements, and organizations and C<sup>3</sup> capabilities necessary to drive AFAS and FARV operations.

Subject of Experimentation/Testing: AFAS Command, Control, and Communications (C3)

Specifications	Environments for Testing/ Experimentation	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment
Fire Mission Coordination. The C <sup>3</sup> subsystem shall be capable of accepting fire support coordination measures in the form of digital messages from the POC and shall automatically apply them to targets in the queued mission list and to the tactical and technical fire control solutions for routine fire requests. The C <sup>3</sup> subsystem will automatically warn the crew when a mission violates fire support coordination measures or unit boundaries defined by battlefield geometry.	AFAS simulator equipped with BCC, radios, modem, and crew station displays.	Detection and warning of violations of fire support coordination measures and friendly battlefield geometry.	Identification of crew warning enunciators activated Target number violating control measures Location  Location of fire support coordination measure and battlefield geometry (maneuver control measure/unit location)  Location of target in call for fire Location of AFAS howitzer  Location of projectile trajectory (as plotted on x,y,z axes)
		Number of Fratricides	Location of fratricides by type if mission fired

Figure 20.2.2 DIS-Ability Matrix

20.3 Determine DIS Protocol Data Unit [PDU] Requirements. We examined the data elements contained in the DIS-ability matrixes, and identified DIS PDUs that would contain the data. Our principal reference for this effort was the <u>Standard for Distributed Interactive Simulation Application Protocols</u>, Version 2.0 (Fourth Draft), published by Institute for Simulation and Training. We formalized the linkage of the applicable PDUs with the data needed to support each measure of performance by adding a fifth column to our DIS-Ability Matrix. See Figure 20.3. During our analysis if data required to support a measure of performance was not contained in established PDUs, we called this out and provided recommendations for new enumeration values or an extension of DIS standards.

Subject of Experimentation/Testing. AFAS Command, Control, and Communications (C3)

Specifications	Experimentation	Measures of Performance		Existing, Modified, or New DIS PDUs Required to Collect Data Elements (X = Unsupportable by DIS PDUs)
Fire Mission Coordination. The C <sup>3</sup> subsystem shall be capable of accepting fire support coordination measures in the form of digital messages from the POC and shall automatically apply them to targets in the queued mission list and to the tactical and technical fire control solutions for routine fire requests. The C <sup>3</sup> subsystem will automatically warn the crew when a mission violates fire support coordination measures or unit boundaries defined by battlefield geometry.		Detection and warning of violations of fire support coordination measures and friendly battlefield geometry.  Number of Fratricides	Target number violating control measures	Event Report PDU  Signal PDU; Event Report PDU  Recommend use of Event Report PDU to report control measure violations and fratricides based on examination of the data elements detailed under Location.  Signal PDU  Entity State PDU  Entity State PDU  Entity State PDU

Figure 20.3 DIS PDU Requirements

Subject of Experimentation Testing. AFAS Command, Control, and Communications (C3). The C3 Subsystem provides for system level control of the AFAS. It provides AFAS with the capability to communicate and is comprised of the following elements: displays and controls for each crew member to include exterior vision devices; fire control computations and commands for the control of defensive armament pointing elements; factical planning and execution support to the crew; internal and external communications equipment; and the capability to determine the system's present location in support of navigation.

## 1. Data Collection Requirements

Specifications	Environments for	Measures of	Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs
	Experimentation	remonwance	Concession if Dis virtual simulation is Appropriate Environment	(X = Unsupportable by DIS PDUs)
FARV Communications Interface. AFAS will	APAS simulator	Digital	Station identification	
have a communications interface with the	equipped with BCC,	messages are		
FARV upon establishing a physical interface	radios, modem,	exchanged	Sender	ransmitter PDU
and data communications connection shall be	station displays	FARV and	Receiver	Receiver PDU
automatically established between the docking		AFAS by wire		
systems during docking.		connection	Time (Voice communications have time stamp	
,		and are	only)	
		decipnerable	Time message transmitted	Sional PDI
		nodes.		
			Time message acknowledged by receiving node	Signal PDU
		Crew has serviceable	Time message processed by receiver	Event Report PDU
		voice		
		communi-	Message type (message type pertains to digital messages only; voice measages tracked by time	Signal PDU
		connection	stamp)	
		with the		
		Number of	Digital	Signal PDU
		uigitai messa <i>o</i> es	Voice	Signal PDU
		transmitted by	200	
		type, receiver	Communications Medium	
		processing	::	į
		time, and	Wire	Signal PDU
		time.	Items resupplied	
		Number of	Number of projectiles transferred by type	Event Report PDU
		projectiles and amount of	Amount of propellant transferred	Event Report PDU
		propellant, and fuel	Amount of Fuel Transferred	Event Report PDU
		transferred		-
		and time	Time required to complete resupply	
		complete the	Time to transfer all projectiles	Event Report PDU
		item.	Time to transfer propellant	Event Report PDU
			Time to transfer fuel	Event Report PDU

Subject of Experimentation/Testing: AFAS Command, Control, and Communications (C3)

Consection if Dis virtual Station is Appropriate Station identification Sender
Receiver Time
Time message transmitted Time message acknowledged by receiving node
Time message processed by receiver
Message wait time by node, net, and priority
Message type and priority
wessage content
Communications Medium
Wire
Radio net ID
Time
Time Ballistic Computation Computer (BCC) acknowledges fire mission
Time resupply completed
Time first round fired
Time each subsequent round fired

Subject of Experimentation/Testing: AFAS Command, Control, and Communications (C3)

Specifications	Environments for	Measures of	Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs
	Testing/ Experimentation	Performance	Collection if DIS Virtual Simulation is Appropriate Environment	Required to Collect Data Elements (X = Unsupportable by DIS PDUs)
Multiple Round Simultaneous Impact. The C3	Live fire	Total time	Time	
MRSI missions.	AFAS simulator	and last round	Time each projectile fired	Detunation PDU
	equipped with BCC, radios, modem, and		Time of flight for each projectile fired	Event Report PDU
	displays to	MRSI range	Time first round impacts	Detonation PDU
			Time last round impacts	Detonation PDU
	requirements and		Location	
	effects on the target,	Outcome of	Location of target in call for fire	Detonation PDU
	within the allotted time frame.	engagement	Location of firing AFAS	Fire PDU
			Effects on target	
			Vehicle and force identification	Entity State PDU
			Mobility kills	Entity State PDU
			Fire control kills	Entity State PDU
			Communication kills	Receiver PDU
			Area visually obscured	Entity State PDU
			Area illuminated	Suggest extension of DIS standards to allow representing illumination as an environmental entity, much like
				a smoke cloud is handled now.

Subject of Experimentation/Testing: AFAS Command, Control, and Communications (C3)

Specifications	Environments for	Measures of	Characteristics and Their Data Floments for	Existing Modified or New DIS PD Le
	Totaling		Collection if Die Victoria Cimulation in American	Brownia A Call A Date Bloom
	Experimentation		Concession in Distributed Simulation is Appropriate Environment	(X = Unsupportable by DIS PDUs)
Responsiveness. The C3 Subsystem shall be	Live fire		Time	
repuirements.	AFAS simulator	Mission	Time fire mission acknowledged by BCC	Event Report or Message PDU
	equipped with BCC,	response time		
	em, and	for emplaced	Time BCC completes tactical fire direction	Event Report PDU
		Aras	Time BCC completes technical fire direction	Event Report PDU
	determine if Co Subsytem can		Time autoloader completes loading of first round	Event Report PDU
	allotted time frame		Time first round fired	Fire PDU
	to meet overall response times.	Mission	Time vehicle stops in firing position	Entity State PDU
		response time for moving AFAS		
		Mission response time	Time primary power applied to system (no auxiliary power running)	Event Report PDU
		cold status	Time all subsystems fully operational	Event Report PDU
		Mission response time	Time primary power applied to system (auxillary power is running)	Event ReportPDU
	_	warm status	Time all subsystems fully operational	Event ReportPDU
Range. The C <sup>3</sup> Subsystem shall be capable of providing ballistic solutions to support range requirements.	Live fire			
Bias and Precision. The C <sup>3</sup> Subsystem shall perform technical fire control functions	Live Fire			
required to achieve precision and bias requirements.				

Subject of Experimentation/Testing: AFAS Command, Control, and Communications (C3)

Specifications	Environments for Testing/	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate	Existing, Modified, or New DIS PDUs Required to Collect Data Hemonta
	Experimentation		Environment	(X = Unsupportable by DIS PDUs)
shall	Live fire	Sensor	Type of self defense sensor activated	Event Report PDU
provide support to the direct fire mission.	4. 4. 4. 4. 4. 4. 4. 4. 4. 4. 4. 4. 4. 4	activation		
NOTE: In addition to testing/experimenting	Simulator that	Detection to	Time	
with direct fire sighting and fire control	warnings and a	firing time		
equipment, sensors in the self defense suite	direct fire sighting	)	Time sensor activated alerting AFAS crew	Event Report PDU
may be tied into the experiment.	and firing capability to gunner identical		Time AFAS fires direct fire mission	Fire PDU
	AFAS.	Engagement	Location	
		point of	Firing vehicle	Fire PDU
		ımpacı	Target vehicle	Detonation PDU
			Location of ordnance impact if target vehicle engaged but not hit.	Detrnation PDU
		Type projectile fired	Type projectile Projectile type and number fired fired	Fire and Detonation PDUs
		Outcome of	Effects on AFAS and target vehicle	
		direct fire		
		engagements	Vehicle and force identification	Detonation PDU
			Operational vehicting	Entity State PDU
			Mobility kills	Entity State PDU
			Fire control kills	Entity State PDU
			Communication kills	Receiver PDU
			Area visually obscured	Entity State PDU

Subject of Experimentation/Teating: AFAS Command, Control, and Communications (C3)

				P. J. A. S. A. S. A. Now Mc Phila
Specifications	Environments for Measures of		Characteristics and I heir Data Elements for Collection if DIS Virtual Simulation is Appropriate	Required to Collect Data Elements
	Experimentation		Environment	(X = Unsupportable by DIS POUs)
Centralized Operations. The C3 Subsystem	Live fire	٥	Sender	Transmitter PDU
shall provide support for centralized, decentralized and senior / subordinate	AFAS simulator	Messaging between POC	Receiver	Receiver PDU
operations. The system shall be capable of equipped with BCC supporting standard, MRSI, and time-on-target and radios capable	equipped with BCC and radios capable	and AFAS at both nodes.	Message Type	Signal PDU
missions. In centralized operations, the C3 subsystem shall perform technical fire control	of transmitting and receiving digital		Message Content	Signal PDU
to execute its assigned fire missions. Tactical fire control shall be performed by the POC or a	trainc.		Time	
higher level of command.		AFAS fire	Time BCC acknowledges fire mission	Event Report PDU
NOTE: Implied in this specification is that each AFAS subsystem involved in the delivery		mission processing	Time BCC completes technical fire direction	Event Report PDU
of fire will complete its fire control function within the allotted time frame so that the		time by subsystem	Time Autoloader completes loading	Event Report PDU
overall response time and rate of fire requirements are achieved.			Time each round fired by type projectile	Fire PDU

Subject of Experimentation/Testing: AFAS Command, Control, and Communications (C3)

Environments for Testing/
-
Messaging
and AFAS.
AFAS fire
processing time by
subsystem
warming or violations of
battlefield
Outcome of
engagement

Subject of Experimentation/Testing: AFAS Command, Control, and Communications (C3)

Specifications	Environments for Testing/ Experimentation	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Elements (X = Unsupportable by DIS PDUs)
Fire Mission Preplanning. The C <sup>3</sup> subsystem shall be capable of storing and executing up to 30 targets.	Live fire AFAS Simulator with BCC and radios installed to enable crew to	Number of stored planned targets.	Target number of each planned target in BCC	Event Report PDU
	transmit digital communications	mission processing time by subsystem	Time BCC acknowledges fire mission for planned target	Event Report PDU
	store planned targets.		Time BCC completes technical fire direction	Event Report PDU
	)		Time BCC completes tactical fire direction	Event Report PDU
			Time Autoloader completes loading	Event Report PDU
			Time each round fired by type projectile	Fire PDU
Fire Mission Coordination. The C3 subsystem shall be capable of accepting fire support coordination measures in the form of digital	AFAS simulator equipped with BCC, radios, modem, and	Detection and warming of violations of	Identification of crew warning enunciators activated Target number violating control measures	Event Report PDU  Event Report PDU
messages from the POC and shall automatically apply them to targets in the one-ned mission list and to the tartical and	crew stanon displays.	rire support coordination measures and	Location	
technical fire control solutions for routine fire requests. The C <sup>3</sup> subsystem will automatically		friendly battlefield	Location of fire support coordination measure and battlefield geometry (maneuver control	Recommend use of Event Report PDU to report violations of control
warn the crew when a mission violates are support coordination measures or unit boundaries defined by battlefield geometry.		. ( )	Location of target in call for fire	of the data elements detailed under
			Location of AFAS howitzer	
			Location of projectile trajectory (as plotted on x,y,z axes)	
Fire Support Display. The C3 shall display friendly and enemy locations and boundaries	APAS simulator with installed crew	Selectivity of graphical data	Location	
graphically to the crew on request. The display of this information and the crew member(s) to which it is displayed shall be selectable by the	radios and modems capable of running	map of area of operations.	Location of friendly units	Entity State PDU
correlating this information to their areas of	crew station software developed		Location of enemy units	Entity State PDU
operation, this importance state of overland on a digital map display of the area.	contractor.		Location of fire support coordination measures and battlefield geometry	Signal PDU

Subject of Experimentation Testing: AFAS Command, Control, and Communications (C3)

	Teating/	Performance	Collection if DIS Victual Simulation is Ammoriate	Existing, Modified, or New DIS PDUs
	Experimentation		Environment	(X = Unsupportable by DIS PDUs)
	AFAS simulator	Identification	Target number of FPF	Event Report PDU
addition to the 30 queued targets, the C3 subsystem shall separately plan and store one	with BCC, radios, displays, and	of stored FFF		
	modem installed.	5		
shall have the highest priority. The crew shall				
the ABAC's status results to its institution to		Crew notification of	Activation of crew enunciator indicating AFAS's inshill to annual the mission	Event Report PDU
support the mission.				
		support FPF		
MOLE: Implied in this specification is that the PPC will identify the reason why the AFAS is		Reason unable	Range	Recommend an Event Report PDI
no longer able to support the FPF mission so				containing this data (range,
the crew or POC can reposition the howitzer or		,	Location of FPF	immediate and intervening crests,
assign the mission to another howitzer.			AFAS howitzer location	the BCC determines that the AFAS is
			Immediate and intervening crests	unable to support the FFF.
			Location of projectile trajectory (on x,y,z axes)	
			Location and altitude of immediate and intervening	
			Ammunition	
			Number of projectiles on board that are of the type needed to support the FPF	
			4 - 27 ABBA 78	
		of FPF "did		
		hit" and	Location of impacting ordnance	
		locations	Location of planned FPF	
			Location and type of fratricdes	
Technical Fire Control. The C3 subsystem shall Live fire perform battlefield geometry and ballistics computations to develop fire control commands for the primary armament subsystem. Technical fire control solutions shall include interior, exterior, and terminal ballistics determinations required to optimally execute assigned fire missions while minimizing its exposure and operating signature. Unless timely resupply of ammunition to support a mission is expected, technical fire control computations shall be based on the inventory of ammunition available on board the AFAS.	Live fire		-	

Subject of Experimentation/Testing: AFAS Command, Control, and Communications (C3)

Specifications	Environments for Measures of	Measures of	Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs
	Testing/	Performance	Collection if DIS Virtual Simulation is Appropriate	Required to Collect Data Elements
	Experimentation		Environment	(X = Unsupportable by DIS PDUs)
Battlefield Geometry. The C3 Subsystem shall		Planned and Location	Location	
be capable of determining range, vertical	with installed crew	fired projectile		
interval, direction and intermediate crest	station displays,	trajectories	Location of fire support coordination measures	Signal PDU
information. Trajectories shall clear all	radios and modems clear	clear	and battlefield geometry	
intermediate crests and other masks to firing	capable of running intermediate	intermediate	•	
in accordance with established	crew station	crests and	Location of target in call for fire	Signal PDU
commander's/mission criteria. Clearance	software developed	friendly		9
distances shall be in accordance with applicable by the DEMVAL	by the DEMVAL	battlefield	Location of AFAS howitzer	Fire PDU
safety rules.	contractor.	geometry.		
			Location of projectile trajectory (x,y,z axes)	Entity State PDU
			Location of intermediate crests and respective altitudes	Event Report I'DU to indicate that an intermediate over the country of the countr
				projectile's trajectory.
			Location of fratricides by type	Entity State PDU

Subject of Experimentation/Teeting: AFAS Command, Control, and Communications (C3)

Specifications	Environments for	Measures of	Characteristics and Their Data Elements for	Scieting, Modified, or New DIS PDUs
	Testing/ Experimentation	Performance	Collection if DIS Virtual Simulation is Appropriate Environment	Required to Collect Data Elements (X = Unsupportable by DIS PDUs)
Self Location/Gun Pointing. The C3	Field tests	AFAS's	AFAS's location	Entity State POU
Subsystem shall have an independent self	employing actual	location,		
locating and gun pointing capability consistent	DEM/VAL location,	altitude, and	AFAS's altitude	Entity State PDU
With Dias and precision requirements.	artitude, and	tube azimutn	AFAS's hits azimuth	
northing, easting and altitude in meters, using	determining	terrain is		
the conventions of the Universal Transverse	equipment that	identical to		
Mercator (UTM) coordinate system. Gun	compare computed	the data in the		
pointing in azimuth and elevation shall be	data to surveyed	BCC and other		
provided in terms of artillery mils. The C3	position data	components		
subsystem shall be capable of accepting	derived by other	(i.e. decision		
azimuths referred to true, grid, and magnetic	methods.	aids) in the C		
moran.	AFAS simulator	oursystem.		
	with C3 Subsystem			
	that receives			
	and tube azimuth			
-	from the			
	Simulator's own			
	and uses the			
	received data to			
	update the BCC and			
	other components			
	of the C <sup>3</sup> Subsystem.			
	Although this			
	approach does not			
	verify the			
	functioning of			
	AFAS & actual self			
	pointing	•		
	equipment, it does			
	provide data to			
	support verification		-	
	of other C3			
	Subsystems that use			
	position and			
Interior Ballistics The Clauberston shall	Live fire			
required to achieve the projectile muzzle				
velocity required to engage the assigned target.				
compensation for variations in parameters				
that affect muzzle velocity consistent with bias				
and precision requirements.				

Subject of Experimentation/Testing: AFAS Command, Control, and Communications (C3)

	7 1	70 00000000		
	Testing/	Performance	Collection if DIS Virtual Simulation is Appropriate	Required to Collect Data Hemests
	Experimentation		Environment	(X = Unsupportable by DIS PDUs)
Muzzle Velocity Compensation. The C3 subsystem shall be capable of compensating for round-to-round variation in muzzle velocity. Muzzle velocity shall be recorded for every round fired.	Live fire			
Exterior Ballistics. The C3 Subsystem shall be capable of compensating for non-standard meteorology. Exterior ballistics computations shall also address, as the situation mandates, any other parameters which affect exterior ballistics such as visibility and height of clouds which affect M712 Copperhead missions.	Live fire			
Minimum Quadrant Elevation. As part of the exterior ballistic solution, the C3 subsystem shall uniquely determine the minimum quadrant elevation associated with each mission and check for compliance with it and other masks to firing in accordance with the commander's/mission criteria. The C3 Subsystem shall also check for clearance of all intermediate crests. The checks for intermediate crest clearance shall use digital map databases available as standard products from the Defense Mapping Agency.	Field tests involving actual DEMVAL equipment that measure immediate crests and locate obstructing intermediate crests along the projectife's trajectory and determine minimum quadrant elevation.			
Projectile Weight Compensation. The C3 Subsystem shall perform both interior and exterior ballistic computations using individual weights of projectiles contained in the on-board magazine accurate to 0.05 kg (0.1 lb). For situations wherein the projectiles in the APAS magazine have not been weighed and coded to the nearest 0.05 (0.1 lb), the C3 Subsytem shall compute ballistics based on the current square method of weighting projectiles. When such projectiles are used, the associated degradation in precision associated with the less accurately known weight is acceptable.	Live fire		-	
Terminal Ballistics. The C3 Subsystem shall perform terminal ballistics computations to achieve the terminal effects desired. Terminal ballistics shall be performed integral to internal and externor ballistics and shall address parameters such as height of burst, fuzz, projectile type, and weather.	Live fire			

Subject of Experimentation/Testing: AFAS Command, Control, and Communications (C3)

Specifications	Environments for	Measures of	Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs
	Testing	Performance	Collection if DIS Virtual Simulation is Appropriate	Required to Collect Data Elements
	Experimentation		Environment	(X = Unsupportable by DIS PDUs)
Senior to Subordinate Howitzer - Tactical and	AFAS simulator	Distance	Location	
Technical Fire Control. When the AFAS is	equipped with BCC, between	between		
operating as a senior or subordinate howitzer,	radios, modem, and senior and	senior and	Location of senior AFAS	Entity State PDU
the C3 Subsystem shall be capable of providing	crew station	subordinate		•
tactical and technical fire control for itself and	displays to	howitzer	Location of subordinate AFAS	Entity State PDU
one subordinate howitzer at the direction of	determine if			•
the POC when the two howitzers are separated	AFAS's C3	Senior AFAS Time	Time	
_	Subsystem can	pue		
provide the same level of tactical and technical	respond to	subordinate	Time senior howitzer acknowledges fire mission	Event Report PDU
fire capabilities for itself and its subordinate as	missions within the	within the AFAS mission		
it normally provides for itself. The capabilities	allotted time frame	response	Time first round fired by senior howitzer	Fire PDU
of the C3 Subsystem shall be such that the	during senior -	times		-
senior howitzer suffers no degradation in its	subordinate		Time first round fired by subordinate howitzer	Fire PDU
ability to simultaneously execute its own	howitzer			
assigned mission. When operating in this	operations.		For MRSI missions time span between impact of	Detonation PDU
mode, both howitzers shall execute the same	•		first and last round fired by senior howitzer	
missions; i.e. all missions shall be executed as	Live fire to			
two gun missions for the duration of the	determine the		For MRSI missions time span between impact of	Detonation PDU
senior/subordinate link. Round to round	impact of		first and last round fired by subordinate howitzer	
corrections for the subordinate howitzer are	senior/subordinate			
not required. The subordinate howitzer will	responsibilities of			
only shoot fire for effect missions or the fire for	senior howitzer			
effect phase of adjust fire type missions.	responsiveness in			
	the actual firing.			

Subject of Experimentation/Testing: AFAS Command, Control, and Communications (C3)

Specifications	Environments for	Measures of	Characteristics and Their Data Bemeals for	Exleting, Modified, or New DIS PDUs
	Testing/	Performance	Collection if DIS Virtual Simulation is Appropriate	Required to Collect Data Blements
Т	EA PERIMENTATION	1		Constant of the standards
_aying	Field testing using	Distance	Location	
When AFAS is operating as a senior or	surveyed sites to	between		
n shali	determine accuracy	senior and	Actual location of senior AFAS	Entity State PDU
be capable of providing location and	of orientation data	subordinate		
witzer that	provided by the	howitzer	Actual location of subordinate AFAS	Entity State PDU
	senior howitzer to			•
itself. This function shall be provided when	the subordinate	Accuracy of	Location provided to subordinate howitzer	Signal PDU
the two howitzers are separated by up to 1 km.	howitzer.	orientation	•	
Performance of this function shall not require	-	data provided	Azimuth	
-	AFAS simulator			
	equipped with BCC,	subordinate	Azimuth of fire of senior howitzer	Entity State PDU
	radios, modem,	howitzer		•
howitzers have stopped in their respective	crew station		Azimuth of fire provided to subordinate howitzer   Signal PDU	Signal PDU
<u>∞</u>	displays, and AFAS		•	
	software package to		Altitude	
more than a 10 percent degradation in the	determine if			
tzer.	orientation data		Altitude provided to subordinate howitzer	Signal PDU
	provided to the		•	
	subordinate		Actual altitude of subordinate howitzer	Entity State PDU
	howitzer is			•
	reasonably accurate,			
	given the state of			
	the art of virtual			
	terrain. Simulation			
	would also exercise			
	and verify soldier-			
	machine interfaces			
	in senior to			
	subordinate			
	howitzer			
	procedures.			

Subject of Experimentation/Testing: AFAS Command, Control, and Communications (C3)

Specifications	Environments for Testing/	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Elements (X = Unaumoortable by DNS PONE)
Radios and Nets. The C <sup>3</sup> Subsystem shall use Single Channel County and Airborne Badio	AFAS simulator	Decipherable digital	Station identification	
Systems (SINCGARS) AN/VRC-924 (long	communications	messages are	Sender	Transmitter PDU
	replicating tactical	between APAS FARV	Receiver	Receiver PDU
data communications. The C <sup>3</sup> Subsystem digital radio shall always operate on the		and POC.	Time (Voice communications have time stamp only)	-
platoon fire direction net and its voice radio on the battery command net. All digital		Crew has serviceable	Time message transmitted	Signal PDU
command and control messages including the assignment of fire missions shall be received		voice communi-	Time message acknowledged by receiving node	Signal PDU
Via this link.			Message type (message type pertains to digital messages only; voice messages tracked by time stamp)	Signal PDU
			Message content	
			Digital	olgnal roo
			Voice	
			Communications Medium	
			Radio net ID	Signal PDU
Automated Fire Support. The C3 Subsystem	AFAS simulator	Time message	Station identification	
shall be capable, when enabled by the COS, or automatically responding to calls for fire from	radios, modem, and	AFAS from	Sender	Transmitter PDU
dentification of authorized sources. Identification of authorized sources shall be as	displays.	authorizing a	Receiver	Receiver PDU
acquisition sources shall be accomplished		between	Time	
unough the PCC which provides for the automatic relay of the message from the		target	Time message transmitted	Signal PDU
sources net to the platoon are direction net.		Source	Time message acknowledged by receiving node	Signal PDU
		Time COS	Message type	Signal PDU
		establishes direct link	Message content	Signal PDU
		with target acquisition	Communications Medium	
		Source	Radio net ID	Signal PDU

Subject of Experimentation/Testing: AFAS Command, Control, and Communications (C3)

		77	-7	E LA TREATMENT IN THE BEST
Specification	Testing/	Performance	Collection of DIS Virtual Simulation is Amenorists	Recuired to Collect Data Homonte
	Experimentation		Environment (X = Unsupportable by DIS PDUs)	(X = Unsupportable by DIS PDUs)
_	Live fire		Content of voice fire command (may require human	Signal PDU
mands for manual eived over the	SIL		recognition and recording of content)	
battery command (voice) net.	A EAC cimulatos	with BCC data	Del a dei benefes allement alag	TOO stored seed to
	equipped with BCC and radios.	9911113	Cata manually emercu muo SCC	Even nepon 1 DO
	AFAS simulator	AFAS crew	Station identification	
provide the capability for the two radios to	with	has		:
exchange voice and data roles without the	communications	serviceable	Sender	Transmitter PDU
need for the crew to physically change	capabilities	digital and		
	radios and modems	communi-	Neceiver	Necessary 100
digital net. If both radios fail, the howitzer	with a simulation	cations when	Time (Voice communications have time stamp	
shall either operate with another howitzer in a	capability to link	two radios are	only)	
subordinate role if the tactical situation	two ArASs together	operational.		
warrants or shall be considered out of action.	by wire in the event	Decinherable	lime message transmitted	Signal P.C.
	radios in one AFAS.	digital	Time message acknowledged by receiving node	Signal PDU
		messages are	· · · · · · · · · · · · · · · · · · ·	
		exchanged	Time message processed by receiver	Event Report PDU
		APAS, FARV	Time when one radio inoperable	Event Report PDU
		and POC	;	
		when a single	Time when two radios inoperable	Event Report PDU
		operational.	Time when communications initiated between	Event Report PDU
		, 1	Senior and Subordinate (disabled) howitzer by a	
		AFAS crew	wire connection	
		AFAS with	Message type (message type pertains to digital	Signal PDU
		serviceable	messages only; voice messages tracked by time	
		radios to an	stamp)	Signal PDU
		radios	Message content	
			Digital	Signal PDU
			Voice	
			Communications Medium	
			Radio net ID	

Subject of Experimentation/Testing: AFAS Command, Control, and Communications (C3)

Specifications	Environmenta for	Messires of	Characteristics and Their Date Demants for	Palestine Madidad as Nam Die BVI
	Testing/	Performance	Collection if DIS Virtual Simulation is Appropriate	Becuired to Collect Date Blancate
	Experimentation		Environment	(X = Unsupportable by DIS PDUs)
Internal Communications. Internal	AFAS simulator	Serviceable	Time Stamped Voice Audio	Signal PDU
communications between crew members shall	with tactical or	VQi×;e		
be provided via the Vehicular Intercom	commercial crew	intercom is	Communications Medium	
System.	intercom.	provided to		
		the crew	Intercom	Signal PDU
	simulator does not			
	provide the fidelity			
	to verity operations			
	of communications			
	equipment, the			
	radios will enable			
	the evaluation of			
	various C3			
	configurations and soldier-machine			
	interfaces.			
Intercom Ports. Intercom ports shall be	AFAS with tactical	Intercom ports	Time Stamped Voice Audio	Signal PDU
provided at each crew station and at each	or commercial	support digital		
remote location a crew member may be	intercom ports	and voice	Communications Medium	
required to occupy. A port shall be provided		traffic.		
on the exterior of the system to allow			Intercom	Signal PDU
communications with personnel outside the				
A 11 A 1 A 1 A Contact Contact and discolution	A PAC CITTLE ACC	S.1040.12	N	
shall be canable of being energied audio aleris	AFAS SIMUIATOR	Survivability	Number of operational AFASs at end of experiment by two of audio alerts activated	
intercom.	Subsystem	by type and		
		number of	ID of each operational vehicle	Entity State PDU
		audio alerts		
		activated.	Iypes of audio alerts activated by time and operational vehicle ID	Event Report PDU
			Number of AFASs sustaining combat damage and/or requiring unscheduled maintenance at end	
			of experiment by Alerta Activated	
			ID of each disabled vehicle	Entity State PDU
			Nature of combat damage or maintenance	Entity State PDU
			deficiency	
			Types of audio alerts activated by time and disabled vehicle ID	Event Report PDU

Subject of Experimentation/Testing: AFAS Command, Control, and Communications (C3)

Specifications	Environments for	Measures of	Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs
	Testing/ Experimentation	Performance	Collection if DIS Virtual Simulation is Appropriate Environment	Required to Collect Data Elements (X = Unsupportable by DIS PDUs)
Inter-vehicular Communications. The C3	AFAS simulator	Crew has	Station identification	
Subsystem shall be capable of communicating	with	serviceable		
with selected / designated howitzers and other	communications	voice	Sender	Transmitter Signal PDU
resupply vehicles through the use of the	capabilities	communi-		
combat net radio set.	replicating tactical	cations.	Receiver	Receiver PDU
	radios and modems.	Digital	Time (Voice communications have time atoms	
		8	take (voice communications have time statisty	
		exchanged		
		among AFASs	Time message transmitted	Signal PDU
		are	Time message acknowledged by receiving node	Signal PDU
		decipherable		
		among all	Fime message processed by receiver	Event Report PDU
			Message wait time by node, net, and priority	Event Report PDU
		Percent of		
		node and net	Message type and priority (pertains to digital	Signal PDU
		nse	messages only; voice messages tracked by time	
		Number of		
		messages	Message content	
		transmitted by		
		node, net, and	Digital	Signal PDU
		priority	Voice	Signal PDI
		Average		
		dnened	Communications Medium	
		message wait		
		time by node,	Wire	Signal PDU
		net, and	!	
		priority	Radio net ID	Signal PDU
		Average		
		number of		
		pananb	-	
		messages by	-	
		node, net, and		
		priority		

Subject of Experimentation/Testing: AFAS Command, Control, and Communications (C3)

Specifications	Environments for	Measures of	Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs
•	Testing	Performance	Collection if DIS Virtual Simulation is Appropriate	Required to Collect Data Elements
	Experimentation		Environment	(X = Unsupportable by DIS PDUs)
Safety Aids. The C3 Subsystem shall include	AFAS simulator		Number of operational AFASs at end of experiment	
capabilities to support the crew in monitoring	with installed C3	Surviving	by type of safety aid/alert activated	
system safety status.	Subsystem	_		
	•	AFASs by type	ID of each operational vehicle	Entity State PDU
		and number		•
		of safety	Types of safety alerts activated by time and	Event Report PDU
		aids/alerts	operational vehicle ID	•
		activated.		
			Number of AFASs sustaining combat damage	
		Number of	and/or requiring unscheduled maintenance at end	
		AFASs	of experiment by safety aids/alerts activated	
		sustaining	•	
		combat	ID of each disabled vehicle	Entity State PDU
		damage or		
		inoperable	Nature of combat damage or maintenance	Entity State PDU
		due to	deficiency	
		maintenance		
		by type and	Types of safety alerts activated by time and	Event Report PDU
		number of	disabled vehicle ID	
		safety		
		aids/alerts		
		T		
Identification Friend or Foe (IFF). The C.	Aras simulator	ectiy	Endry Lype	
Subsystem shall use standard Battlefield	with installed C	identify		
Combat Identification System procedures and	Subsystem and IFF	entities	Irr entity type	Event Report PDU
equipment to reduce the potential for		getected by the	Actual entity type	Entity Type PDI
		Subsytem.	odf. frame many	
			Force Identification	
			IFF force identification	Event Report PDU
			Actual Rore identification	Folliw Tune PDI

Subject of Experimentation/Testing. AFAS Command, Control, Communications (C3)

- 2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment.
- Specifications supportable by DIS. Based on the results derived from the above matrix, DIS experimentation/testing appears feasible to assess the operational and technical tradeoffs in AFAS specifications addressing the following areas:
- C<sup>3</sup> Subsystem response time within overall AFAS response time
- C3 Subsystem's capability to support AFAS rates of fire for a single projectile type and mixed projectile types
- C3 Subsystem's capability to support MRSI mission time of impact requirements for a single projectile type and mixed projectile types
- Digital interfaces
- C<sup>3</sup> Subsystem's capability to support direct fire missions
- Degraded communications
- Message formats and content needed to support POC, AFAS, and FARV digital communications
- Placement of internal intercom ports
- Audio and safety alerts
- Centralized AFAS operations
- Decentralized AFAS operations

B - 26

- Fire mission preplanning
- Fire mission coordination
- Fire support display
- Final protective fire updates
- Tactical fire control
- Senior to subordinate howitzer operations
- · Linkage of AFAS to a target acquisition source through a POC relay
- IFF operations
- opportunity to experiment with various soldier-machine interfaces (SMIs), required messaging, net and node message loading, and system and software design architectures to determine the best specified in the AFAS specification. However, the overall impact of design changes can be measured in terms of the battle outcomes at the conclusion of the experiment/scenario. Listed below are example battle statistics that testers/analysts may derive from the data elements in the above matrix to correlate experiment results to design changes: designs to determine operational and technical tradeoffs offered by alternative C3 configurations. Installation of an actual C3 Subsystem prototype in an AFAS simulator provides the Sample Experiment. A single experiment/scenario in the DIS virtual environment can address each of the specifications above. Analysts and testers can run the same experiment lit to meet overall response times and required rates of fire. Placing the AFAS simulator on a combined arms virtual battlefield does not permit validations of firing accuracy to the dagnee
- Number of threat entities sustaining combat damage by AFAS indirect or direct fire by projectile type

# Subject of Experimentation/Testing. AFAS Command, Control, Communications (C3)

- Number of threat entities blinded by AFAS smoke missions by indirect or direct fire
- Percent of node and net use by various phases of the battle
- Number of messages transmitted by node, net, and priority
- Average queued message wait time by node, net and priority
- Average number of queued messages by node, net, and priority
- Number of fire support coordination measure and battlefield geometry violations

Number of threat entities illuminated by AFAS illumination missions

- Number of fratricides resulting from violation of fire support coordination measures and battlefield geometry
- Number of AFASs surviving at the end of the battle/scenario
- Number of missions fired
- Number of projectiles fired by type
- Highest number of projectiles fired by type by minute for a duration of 3 minutes or longer
- Number of MRSI missions fired
- Number of MRSI projectiles fired by type, mission and range
- Mission response time by mission for AFAS while emplaced
- Mission response time by mission for AFAS while moving
- Mission response time by mission for senior AFAS while emplaced
- · Mission response time by mission for senior AFAS while moving
- Time span for impact of all MRSI rounds by mission and range
- Time to process and fire M712 Copperhead by round and mission
- To support experimentation and testing in the areas identified above the following resources are required: 3. Required Resources.
- · One AFAS crew to man an AFAS simulator
- One AFAS simulator complete with C3 Subsystem with BCC, 2 radios, intercom modems, crew stations, crew displays, supporting software.
- One FARV simulator and crew or FARV SAFOR and SAFOR controller to support resupply operations. Fire Support Automated Test System (FSATS) could be upgraded to support digital messaging from a SAFOR FARV to an AFAS manned simulator during docking operations to coordinate and control ammunition and fuel transfer.
- One LRP SAFOR and LRP controller to support FARV upload/download operations.

# Subject of Experimentation/Testing. AFAS Command, Control, Communications (C3)

- One AFAS SAFOR and SAFOR controller to support senior to subordinate AFAS operations. FSATS could be upgraded to support digital messaging from a SAFOR Subordinate AFAS to a Senior AFAS manned simulator to support senior/subordinate howitzer operations.
- One observer to acquire and submit calls for fire to engage opposition force targets on the virtual battlefield. FSATS could be employed as an alternative to generate calls for fire that drive a highly controlled scenario.
- One AFATDS POC computer operator to process the observer's call for fire. Another alternative is to upgrade PSATS POC node so that the PSATS POC may interface
  with AFAS and FARV. Testers could then embed the scenario in PSATS and allow the AFAS and FARV crews to interact with PSATS message traffic generated by the POC or observer nodes as appropriate.
- Threat SAFOR operations order and controller to execute order.
- Friendly force operations order with fire support coordination measures and battlefield geometry and controller to execute order.

Subject of Experimentation/Testing. FARV Command, Control, and Communications (C3). The C3 Subsystem provides for system level control of the FARV. It provides FARV with the capability to communicate and is comprised of the following elements: displays and controls for each crew member to include exterior vision devices; fire control computations and commands for the control of defensive armament pointing elements; tactical planning and execution support to the crew; internal and external communications equipment; and the capability to determine the system's present location in support of navigation.

## 1. Data Collection Requirements

Specialcadons	Environments for	Measures of	Characteristics and Their Data Elements for	Existing, Modified, or New DIS POUs
•		Performance	Collection if DIS Virtual Simulation is Appropriate Environment	Required to Collect Data Elements (X = Unsupportable by DIS PDUs)
Command, Control, and Communications (C3) Dieital Data Interface. The system shall be	FARV simulator equipped with	Digital messages	Station identification	
paou	lem, and	exchanged	Sender	Transmitter Signal PDU
<u> </u>	crew station displays that are	AFASe, and	Receiver	Receiver PDU
200/VM. The system shall be interoperable with AFAS to execute its intended mission.	compatible with AFATDS.	FARVs are decipherable	Time	
		among all nodes	Time message transmitted	Signal PDU
		Percent of	Time message acknowledged by receiving node	Signal PDU
		node and net use	Time message processed by receiver	Event Report PDU
		Number of	Message wait time by node, net, and priority	Event Report PDU
		messages transmitted by	Message type and priority	Signal PDU
		node, net, and priority	Message content	Signal PDU
		Average	Communications Medium	
		message wait	Wire	Signal PDU
		net, and	Radio net ID	Signal PDU
		priority		
		number of		
		queued messages by		
		node, net, and		

Subject of Experimentation/Testing: FARV Command, Control, and Communications (C3)

Existing, Modified, or New DIS FDUs Required to Cellect Data Blements (X = Unsupportable by DIS FDUs)		Transmitter PDU		Receiver PDU				Signal PDC	Signal PDU		Event Report PDU	Signal PDU	•			Signal PDU		Signal PDU		Signal PDU			Event Report PDU	1	Event Report PDU	Event Report PDU	•		Event Report PDU		Event Report PDU	Event Report PDU
Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Station identification	Sender		Receiver	Time (Voice communications have time stamp	only)		ime message transmitted	Time message acknowledged by receiving node		Time message processed by receiver	Message type (message type pertains to digital	messages only; voice messages tracked by time	stamp)	Message content	Digital		Voice	Communications Medium	Wire		Rems resupplied	Number of projectiles transferred by type	•	Amount of propellant transferred	Amount of Fuel Transferred	-	Time required to complete resupply	Time to transfer all projectiles		Time to transfer propellant	Time to transfer fuel
nance	Digital	messages are	between	FARV and			decipherable	Detween		Crew has	serviceable	uni-	ire		With the FARV.	Number of	digital	messages		time, and	ge wait		Number of	projectiles and	amount of	and fuel	<u></u>		consumed to	transfer by	item.	
Environments for Testing/ Experimentation	FARV simulator	equipped with radios, modem.	intercom, and crew	station displays																												
Specifications	Communication Link. A voice and data	communications connection shall be automatically established between the docking	systems during docking. This link shall	provide for the transfer of all control data	The crew shall have direct control of all	transfer processes without having to leave	their crew stations (except for manual rearm).	For rearm, this link shall be established	automatically as a part of the docking process																							

Subject of Experimentation/Testing: FARV Command, Control, and Communications (C3)

Specifications  Specifications  Specifications	Environments for Measures of Testing/ Experimentation PARV simulator		Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Blements (X = Unsupportable by DIS PDUs)
	with communications	į 2	Sender	Transmitter PDU
receiver / transmitters [R/T]) combat net radio for voice and data communications. One R/T will be dedicated to voice and the other to data	capabilities replicating factical radios and moderns	exchanged between AFAS: FARV	Receiver	Receiver PDU
communications.			Time (Voice communications have time stamp	
		Crew has serviceable	Time message transmitted	Signal PDU
		communi-	Time message acknowledged by receiving node	Signal PDU
			Message type (message type pertains to digital messages only; voice messages tracked by time stamp )	Signal PDU
			Message content	
			Digital	Mgrai PDC
			Voice	Signal PDU
			Communications Medium	
			Radio net ID	Signal PDU

Subject of Experimentation/Testing: FARV Command, Control, and Communications (C)

Specifications	Environments for	Measures of	Characteristics and Their Data Elements for	Edsting, Modified, or New DIS PDUs
	Testing/	Performance	Collection if DIS Virtual Simulation is Appropriate	Required to Collect Data Elements
Experimentation	Experimentation		Environment	(X = Uneupportable by DIS PDUs)
Automatic Response to Support Requests. The	FARV simulator	Number of	Station identification	
C3 Subsystem shall be capable of automatically equipped with	equipped with	resupply		
processing requests for support and then	radios, modem,	requests in	Sender	Transmitter PDU
automatically relaying information back to the		which PARV		
requester. The system shall allow the crew to	station displays, and	automatically	Receiver	Receiver PDU
disable this function and to hold the	decision support	provides		
subsystem's prepared response transmission	system software	Information	Time	
for crew release.		to the		
		requester.	Time message received by FARV C3 Subsystem	Signal PDU
		Number of	Time message transmitted to expussion	Signal PDU
		resupply		
		requests in	Message type and response	
		which FARV		
		semi-	Type=resupply	Signal PDU
		provides	Automatic response	Event Report PDU
		information	-	•
		to the	Semi-automatic response	Event Report PDU
			Message content	Signal PDU
			Communications Medium	
			Wire	Signal PDU
			Radio net ID	Signal PDU
Manual Data Entry. The C3 Subsystem shall	FARV simulator	Comparison	Time and content of voice resupply request (may	Signal PDU
allow the crew to enter resupply coordination information, for relay back to requester.	equipped with radios. modem.	of voice data to manually	require human recognition and recording of content)	
manually in response to external taskings.	intercom, and crew	entered data		
	station dispiays		Data manually entered into BCC	Event Report 1-DO

Subject of Experimentation/Testing: FARV Command, Control, and Communications (C)

Specifications	Environments for	Measures of	Characteristics and Their Data Elements for	Existing, Medified, or New DIS PDUs
	Testing/ Experimentation	Performance	Collection if DIS Virtual Simulation is Appropriate Environment	Required to Collect Data Blaments (X = Unsupportable by D1S PDUs)
Flexibility of Use. The C3 Subsystem shall	FARV simulator	PARV crew	Station identification	
provide the capability for the two radios to	with	has		
exchange voice and data roles without the	communications	serviceable	Sender	Transmitter PDU
internancetions If a single failure occurs the	replicating tactical	digital and		
_	radios and modems.			
			Time (Voice communications have time stamp	
		two radios are	only)	
		operational.	Time message transmitted	Signal PDU
		Decipherable		
		digital messages are	Time message acknowledged by receiving node	Signal PDU
		exchanged	Time message processed by receiving node	Event Report PDU
		AFAS, FARV	Time when one radio inoperable	Event Report PDU
		when a single	Time when two radios inoperable	Event Report PDU
		radio is operational.	Message type (message type pertains to digital	
			messages only; voice messages tracked by time stamp )	
			Message content	Signal PDU
			Digital	Signal PDU
			Voice	
			Communications Medium	Signal PDU
			Radio net ID	
Internal Communications. Internal	PARV simulator	Serviceable	Time Stamped Voice Audio	Signal PDU
be provided via the Vehicular Intercom	radios, modem,	voice intercom is	Communications Medium	
System.	intercom, and crew station displays	provided to the crew	Intercom	Signal PDU
	Although a FARV			
	provide the fidelity			
	of communications			
	equipment, the radios will enable			
	the evaluation of			
	configurations and soldier-machine			
	interfaces.			

Subject of Experimentation/Testing: FARV Command, Control, and Communications (C3)

Specifications	Environments for	Measures of	Characteristics and Their Data Elements for	Exieting, Modified, or New Dis POUs
	Testing/ Experimentation	Performance	Collection if DIS Virtual Simulation is Appropriate Environment	Required to Collect Data Elements  (X = Unaupportable by Dis PDUs)
Intercom Ports. Intercom ports shall be	E E	eable	Time Stamped Voice Audio	Signal PDU
remote location a crew member may be	intercom ports	intercom is	Communications Medium	
required to occupy. A port shall be provided		provided to		
on the exterior of the system to allow		the crew	Intercom	Signal PDU
communications with personnel outside the vehicle.				
Audio Alerte. System generated audio alerts	FARV simulator	System	Number of operational FARVs at end of experiment	
shall be capable of being injected into the	with installed C3	bility	by type of audio alerts activated	
intercom.	Subsystem	by type and		
	,	number of	ID of each operational vehicle	Entity State PDU
		audio alerts activated.	Types of audio alerts activated by time and	Fvent Report PDI
			operational vehicle ID	
			Number of FARVs sustaining combat damage	
	-		and/or requiring unocheduled maintenance at end	
			ID of each disabled vehicle	Entity State PDU
			Nature of combat damage or maintenance	Entity State PDU
			deficiency	
			Types of audio alerts activated by time and disabled vehicle ID	Event Report PDU

Subject of Experimentation/Testing: FARV Command, Control, and Communications (C3)

Specifications	Environments for	Measures of	Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs
	Experimentation		Concention is DIS viewes Simulation is appropriate	(X = Unsupportable by DIS PUUs)
Inter-vehicular Communications. The	PARV simulator	Crew has	Station identification	
Subsystem shall be capable of communicating	with	serviceable		
with selected / designated howitzers and other	communications	voice	Sender	Transmitter Signal PDU
resupply vehicles through the use of the	capabilities	communi-		
combat net radio set.	replicating tactical radios and modems.	cations.	Receiver	Receiver PDU
		Digital	Time (Voice communications have time stamp	
		messages	(Aluo	
		exchanged		
		and FARVA	Time message transmitted	Signal PDU
		are	Time message acknowledged by receiving node	Signal PDU
		decipherable		
		among all	Time message processed by receiver	Event Report PDU
			Message wait time by node, net, and priority	Event Report PDU
		Percent of		
		node and net	Message type and priority (pertains to digital	Signal PDU
		use	messages only; voice messages tracked by time stamn l	
		Number of		
		messages	Message content	
		transmitted by		
		node, net, and	Digital	Signal PDU
		priority		
			Voice	Vignal PCC
		Average	Communications Medium	
		message wait		
		time by node,	Wire	Signal PDU
		net, and		
		priority	Radio net ID	Signal PDU
		Average		
		number of		
		dnened		
	-	messages by		
		node, net, and		
		7		

Subject of Experimentation Testing: FARV Command, Control, and Communications (C3)

		ı		
Specifications	Environments for		Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs
	Testing/ Experimentation	Performance	Collection if DIS Virtual Simulation is Appropriate Environment	Required to Collect Data Elements (X = Unaupportable by DIS PDUs)
Safety Aids. The C <sup>3</sup> Subsystem shall include	FARV simulator	Number of	Number of operational FARVs at end of experiment	
capabilities to support the crew in monitoring	with installed C3		by type of safety aid/alert activated	
system safety status.	Subsystem	operational		
		FARVs by type	ID of each operational vehicle	Entity State PDU
		and number		
		of safety	Types of safety alerts activated by time and	Event Report PDU
		aids/alerts	operational vehicle ID	
		activated.		
			Number of FARVs sustaining combat damage	
		Number of	and/or requiring unscheduled maintenance at end	
		FARVS	of experiment by safety aids/alerts activated	
		sustaining	•	
		combat	ID of each disabled vehicle	Entity State PDU
		damage or		•
		inoperable	Nature of combat damage or maintenance	Entity State PDU
		due to	deficiency	•
		maintenance		
		by type and	Types of safety alerts activated by time and	Event Report PDU
		number of	disabled vehicle ID	
		safety		
		aids/alerts		
		_		
Identification Friend or Foe (IFF). The C3		rectly	Entity Type	
Subsystem shall use standard Battlefield	with installed C3	identify		
Combat Identification System procedures and	Subsystem and IFF	entities	IFF entity type	Event Report PDU
equipment to reduce the potential for		detected by the		
fratricide.		crew or the C3	Actual entity type	Entity Type PDU
		oupsytem.	Force Identification	
			IFF force identification	Event Report PDU
			Actual Force identification	Entity Type PDU

Subject of Experimentation/Testing: FARV Command, Control, and Communications (C3)

Edating, Modified, or New DIS PDUs Required to Collect Data Bennents (X = Unsupportable by DIS PDUs)		Event Report PDUs to designate each MFR transmitted	Fire and Detonation PDUs			Entity State PDU	Entity State PDU	Entity State PDU		Signal PDU	Transmitter PDU	Receiver PDU	Signal PDU	Event Report PDU		Signal PDU	Transmitter PDU	Receiver PDU	Signal PDU	Event Report PDU
Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Number of fire missions fired	Mission Fired Reports (MFR) transmitted by AFAS to POC	Projectile type and number fired	Vehicles sustaining on maket demonstrate		Number of AFASs	Number of FARVs	Number and type of threat entities	Number of AFAS resupply requests sent directly to FARV	Message type = resupply	Message sender	Message receiver	Time received and acknowledged	Time resupply completed	Number of AFAS resupply requests sent to POC	Message type = resupply	Message sender	Message receiver	Time received and acknowledged	Time resupply completed
Measures of Performance	Number of missions and	projectiles fired		Number of		friendly losses			Number of AFAS		directly to the FARV and	time to complete	resuppiy.		a of	resupply	to the POC	complete	resuppiy.	
Environments for Testing/ Experimentation	FARV simulator with installed C <sup>3</sup>	Subsystem																		
Specifications	Centralized Control. Depending on the level of centralized control, the FARV will either	respond to mission plans and execution instructions from the POC, directly from an	AFAS, or be link-relayed through the POC to an AFAS. By including the POC in the control	link, FARV systems can support the AFAS	pooled to add greater flexibility and	throughput. In general, the AFAS will report	requirements to the POC which will then	dispatch a resupply vehicle (FAKV) to rearm/refuel the AFAS as required. This will	generally take place as the nowitzer moves into a new position. Once the FARV has located the supported AFAS, it will be the	active participant of the docking procedure with the exception of any maneuvering the	AFAS may be required to perform to place itself in an acceptable supply position.									

Subject of Experimentation/Testing. Subject of Experimentation/Testing. FARV Command, Control, and Communications (C<sup>3</sup>)

- 2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment.
- supportable by DIS. Based on the results derived from the above matrix, DIS experimentation/testing appears feasible to assess the operational and technical tradeoffs in FARV specifications addressing the following areas:
- C<sup>3</sup> digital data and voice interfaces
- C<sup>3</sup> configuration
- Automatic and semiautomatic responses to resupply requests
- Degraded communications
- Placement of internal intercom ports
- Audio and safety alerts
- Message formats and content needed to support POC, AFAS, and FARV digital communications
- IFF operations
- FARV centralized and decentralized operations
- simulator provides the opportunity to experiment with various soldier-machine interfaces, required messaging, net and node message loading, and software design architecture's to determine the best fit to meet overall response times for resupply, transloading, and downloading of fuel and ammunition. Placing the FARV simulator on a combined arms virtual battlefield permits evaluation of design changes that can be measured in terms of the battle outcomes at the conclusion of the experiment/scenario. Listed below are example battle statistics that testers/analysts may derive from the data elements in the above matrix to correlate experiment results to design changes: experiment repeatedly altering designs to determine operational and technical tradeoffs offered by alternative C3 configurations. Installation of an actual C3 Subsystem prototype in a FARV Sample Experiment. A single experiment/scenario in the DIS virtual environment can address each of the specifications in paragraph 2.1. Analysts and testers can run the same B - 38
- Percent of node and net use by various phases of the battle
- Number of messages transmitted by node, net, and priority
- Average queued message wait time by node, net and priority
- · Average number of queued messages by node, net, and priority
- Time required to complete resupply, transload, and download under centralized, decentralized operations, and various C3 configurations and messaging.
- Number of missions fired
- Number of threat entities sustaining combat damage
- Number of threat entities blinded by AFAS smoke missions
- Number of threat entities illuminated by AFAS illumination missions
- Number of IFF warnings, audio alerts, and safety warnings
- Number of surviving, operational AFASs and FARVs
- Number of AFASs and FARVs sustaining combat damage or maintenance deficiency.

# Subject of Experimentation/Testing. Subject of Experimentation/Testing. FARV Command, Control, and Communications (C3)

3. Required Resources. To support experimentation and testing in the areas identified above the following resources are required:

- One FARV crew to man a FARV simulator
- One FARV simulator equipped with C3 Subsystem complete with radios, modems, crew stations, crew displays, supporting software.
- One AFAS simulator and crew or AFAS SAFOR and SAFOR controller to fire tons and sup (FSATS) could be upgraded to support digital messaging from a SAFOR A 2 FARV manual ammunition and fuel transfer.

ions and support resupply operations. Fire Support Automated Test System FARV manned simulator during docking operations to coordinate and control

- One LRP SAFOR and LRP controller to support FARV upload/download ¾
- One FARV SAFOR and SAFOR controller to support transload operations beween PARVs. FSAT could be upgraded to support digital messaging from a SAFOR FARV to a FARV manned simulator during transloading operations to coordinate and control ammunition and fuel transfer.

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- One observer to acquire and submit calls for fire to engage opposition force targets on the virtual battlefield. FSATS could be employed as an alternative to generate calls for fire that drive a highly controlled scenario.
- One AFATDS POC computer operator to process the observer's cali for fire. Another alternative is to upgrade FSATS POC node so that the FSATS POC may interface with AFAS and FARV crews to interact with FSATS message traffic generated by the POC or observer nodes as appropriate.
- Threat SAFOR operations order and controller to execute the order
- Friendly force operations order with fire support coordination measures and battlefield geometry and controller to execute the order

Subject of Experimentation/Testing. AFAS Primary Armament

lent				Existing, Modified, or New UIS PUUS
	l esting/ Experimentation	Performance	Collection if DIS Virtual Simulation is Appropriate Environment	Required to Collect Data Elements (X = Unsupportable by DIS PDUs)
With the Dias and precision requirements)-	ive fire			
not less than 30 km unassisted projectile				
not less than 40 km assisted projectile				
Required minimum range (consistent with the bias and precision requirements)-not greater than 6 km at 200 mils elevation.				
The system shall be zoned to provide range				
required projectile fuze combinations except				
M712 Copperhead. Charges shall overlap by 10% of the maximum range of the lower zone				
or 1500 meters, whichever is shorter, when				
firing between 200 mils quadrant elevation and				
overlap by 10% of the maximum range of the				
lower zone when firing between 1244 mils and				
Rate of Fire Required maximum rate of fire.	live fire	Pato of fire	Time	
	,			
	AFAS simulator equipped with BCC,		Time Ballistic Computation Computer (BCC) acknowledges fire mission	Event Report or Message PDU NOTE: Start of the time interval
minute against specified targets until on-board   ra	radios, modem, and crew station			may be at some point other than the time BCC acknowledges for mission
	displays to			such as the time which the BCC
I he system will also be capable of supporting of a	subsystems can			initiates execution of a preplanned fire mission
	perform within			
No more than 90 seconds following the	their allotted time	-	Time resupply completed	Resupply Received PDU
	the required rates of		Time first round fired	Fire PDU
rounds up to maximum storage capacity), the trounds by stem shall once again be capable of operating	STE.		Time each subsequent round fired	NOTE: New enumeration values for
at the maximum rate of fire.				several projectiles may be necessary (i.e. M110, M116, M712)

Subject of Experimentation/Testing. AFAS Primary Armament

Specifications	Environments for	Measures of	Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs
	Testing/	Performance	Collection if DIS Virtual Simulation is Appropriate	Required to Collect Data Elements
	Experimentation		Environment	(X = Unsupportable by DIS PDUs)
Multiple round simultaneous impact (MRSI).	Live fire	Total time	Time	
MRSI missions-the system shall be capable of		between 1st		7.00
firing MRSI missions of at least 4 rounds at all	AFAS simulator	and last round	Time first round impacts	Detonation PDU
ranges between 8 and 36 km with all rounds	equipped with BCC,		•	
_	radios, modem, and		Time last round last round impacts	Detonation PDU
The system shall also be capable of firing MRSI	crew station		-	
missions consisting of two rounds up to the	displays to	MRSI range	Location	
maximum achievable number of MRSI	determine if AFAS			
rounds.	can meet MRSI		Location of target in call for fire	Detonation PDU
NOTE: Leading in this case of the second	requirements and			
rolls: Implied in this specification is the	achieve the desired		Location of firing AFAS	Fire PDU
missions so that if the DEMVAL contractor's	within the allotted		Effects on target	
design falls short of or exceeds the MRSI range	time frames for	MRSI		
or time requirements, the impact of the design shortfall or enhancement can be evaluated	each subsystem.	engagement	Vehicle and force identification	Detonation PDU
			Mobility kills	Entity State PDU
			Fire control kills	Entity State PDU
			Communication kills	Receiver PDU
			Area visually obscured	Entity State PDU
			Area illuminated	Suggest extension of DIS standards to
				allow representing illumination as an environmental entity, much like a smoke cloud is handled now.

Subject of Experimentation/Testing. AFAS Primary Armament

Specifications	Environments for	Measures of	Characteristics and Their Data Elements for	Existing Modified or New DIS PDUs
	Testing/ Experimentation	Performance	Collection if DIS Virtual Simulation is Appropriate Environment	Required to Collect Data Elements
┪	Live Fire	AFAS	Time	
_		response time		
	AFAS simulator	•	Time vehicle stops in firing position	Entity State PDU
required to active the desired effect on target.	equipped with DCC,		Time fire mission asknowledged by BC	Total Description of the Party
	and crew station		time the mission arknowledged by DCC	Event Report of Message P.U.
	displays to		Time first round fired	Fire PDU
se times when firing mixed	determine if BCC		i	
projective types.	and soldler-in-the-		lime last round fired	Fire PDU
	mixed projectile	Projectile mix	Projectile	
	types and achieve	•	•	
	the desired effects		Type	Fire & Detonation PDUS
	on the target,			
	Within allotted time		Number fired	Fire & Detonation PDUS
	subsystem.	Outcome of	Effects on Target	
		engagement	Vehicle and force identification	Detonation PDU
			Mobility kills	Entity State PDU
			Fire control kills	Entity State PDU
			Communication kills	Receiver PDU
			Area visually obscured	Entity State PDU
			Area illuminated	Suggest extension of DIS standards to allow representing illumination as an environmental entity, much like a smoke cloud is handled now.

Subject of Experimentation/Testing. AFAS Primary Armament

or New DIS PDUs				-
Existing, Modified, or New DIS PDUs Required to Collect Data Blements OX - Hamman All L. Dis Bruta				
Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment				
Measures of Performance				
Environments for Testing/	Live fire			
	80 9 F E 9		40m 75m	120m
Specifications	When firing in shall be cap; the cap; t	Bias	55m 80m	140m
ďs	Blas and Precision. When firing the M549A1 projectile, the system shall be capable of providing accurate fires through the following ranges at the prescribed circular error probable (CEP) listed in the table below. Accuracy requirements shall be met when firing the shortest time of flight trajectories. (Note: Bias is radius of a circle containing the MPIs of multiple occasions. One occasion is a number of rounds fired from the same gun with the same data for a short period of time. Precision is the radius from the MPI that produces a circle containing all rounds fired from a single occasion.)	Range Precision	Min. to 15 km 16 to 25 km	26 to 35 km

Subject of Experimentation/Testing. AFAS Primary Armament

Mission Time five mission acknowledged by BCC Time five mission acknowledged by BCC Time five mission acknowledged by BCC Time BCC completes tactical fire direction Time autoloader completes toading of first round E Time first round fired Time first round fired Time wehicle stops in firing position Time autiliary power applied to system (no Buxlisaton auxiliary power running) for APAS in Cot APAS in Time all subsystems fully operational F Mission Time all subsystems fully operational F Time all subsystems fully operational	Specifications	Environments for	Measures of	Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs
infing Live fire  Nation  Fine  Live fire  AFAS simulator  for emplaced fire  for emplaced with BCC completes tactical fire direction  for exponse time  for and other  subsystems can  their alloited time  for AFAS in  for		Testing/	Performance	Collection if DIS Virtual Simulation is Appropriate	Required to Collect Data Elements
onds. SIL response time first equipped with BCC, a FAS simulator crew station determine it BCC and other and other can other allose of and other capprose time frames to make a subsystems can response time frames to met in firme. Mission that the correl the be can and other capprose time frames to met in firme. Mission that the correl capprose time that the correl capprose time the firme all subsystems fully operational that the capprose time that the cappose time that the capprose time that the capprose time that the cappose time that t	Description of Whom opening of thing	ing fire			CA = Champbordable by Uto FDUs)
first equipped with BCC, and displays to display	position, the system shall be capable of	רואב וווב			-
first degrees time first response time first round displays to cere station onds. Subsystems can has response time for moving when the firme and other response time for moving that the for ARAS in the the first round fired and other response time for moving when the for moving that the for ARAS in the the first cold status the formary power applied to system (auxiliary power applied auxiliary power auxiliary power applied a	responding to a fire mission with 20 seconds.	SIL	Mission	Time fire mission acknowledged by BCC	Entity State PDU
fire AFAS simulator for emplaced fire direction fired equipped with BCC AFAS and a feet a complete a technical fire direction fired equipped with BCC AFAS fired and other and other completes to the fired and other and other condensation for AFAS in that the the Live fire the ceep one time the fired	The interval shall start when the system		response time	•	•
rictude radios, modem, and displays to determine if BCC completes technical fire direction displays to determine if BCC and other onds. subsystems can other and other crespond within their allotted time response time frames to meet the for moving when overall response time the the there is a list of the their allotted time. Mission cold status the	acknowledges the error free receipt of the fire	AFAS simulator	for emplaced	Time BCC completes tactical fire direction	Event Report or Message PDUs
displays to  displays to  displays to  displays to  determine if BCC  and other  onds. subsystems can  ther allotted time  overall response time  frames to meet the  overall response time  time.  Mission  cold status  the  the  the  the  the  the  the  th	mission request and shall end when the first	equipped with BCC,	AFAS	Time BC completes tackairal fine discostina	Control Broad to Manager
displays to  determine if BCC  determine if BCC  determine if BCC  and other  thas subsystems can  respond within response time for moving when overall response time frames to meet function overall response time function overall respon	all on-board fire control computations.	crew station		time bee completes technical line direction	Event nepart of message 100s
ble of determine if BCC and other subsystems can respond within the fire all subsystems to meet the for moving when overall response time time.  Mission that the hat the hat the condition warm status the condition warm status  Itime fires tound fired  Time tires tound fired  Time vehicle stops in firing position  Time primary power applied to system (no auxiliary power running)  Time all subsystems fully operational	regardless of the mission.			Time autoloader completes loading of first round	Event Report or Message PDUs
subsystems can trespond the time response time for moving time.  When distance to meet the for moving time time to meet the for moving time.  When overall response time for moving time time.  Mission cold status and status and the for AFAS in cold status the the for AFAS in the the for Mission the the for Mission cold status are sponse time for AFAS in for AFAS in the fire.  Live fire time the for moving auxiliary power applied to system (auxiliary power is running).  Time primary power applied to system (auxiliary power applied to system (auxiliary power is running).  Time all subsystems fully operational time all subsystems fully operational and time in the for AFAS in the fire time the for Mission for AFAS in the fire fire fire the for Mission for AFAS in the fire fire fire fire fire fire fire fir	When moving, the system shall be capable of			Time first round fired	Event Report or Message PDUs
their allotted time response time their allotted time frames to meet the for moving when overall response time frames to meet the for moving when overall response time frames to meet the for moving a list of time.  Mission cold status or AFAS in cold status the their for AFAS in the the for AFAS in the the cold status or the for AFAS in the for AFAS in the for AFAS in the the for a list of the fire the cold status one time one time one time one time for a list of the fire their their their their their the their	responding to a fire mission with 45 seconds.	subsystems can			
when overall response AFAS  when overall response AFAS  when overall response AFAS  when overall response when overall response time response time for AFAS in cold status  that the cold status and the warm status  ble  Live fire  ced  ctiles,  when overall response time auxiliary power applied to system (no response time power is running)  Time primary power applied to system (auxiliary power is running)  Time all subsystems fully operational  Time primary power applied to system (auxiliary power is running)  Time all subsystems fully operational  Time all subsystems fully operational  Time primary power applied to system (auxiliary power is running)  Time all subsystems fully operational  Time primary power applied to system (auxiliary power is running)  Time all subsystems fully operational  Time primary power applied to system (auxiliary power is running)  Time all subsystems fully operational  Time primary power applied to system (auxiliary power is running)  Time all subsystems fully operational	stopped in a suitable firing position and	their allotted time	response time	Time Venicle stops in titing position	
time.  Mission response time for AFAS in cold status  that the caponse time for AFAS in warm status  Live fire caponse time caponse time cold status  Time all subsystems fully operational power applied to system (auxiliary pow	acknowledged the error free receipt of the fire mission request. The interval shall end when	frames to meet the overall response	for moving AFAS		
Mission (and status)  Time all subsystems fully operational for AFAS in response time (and status)  Time all subsystems fully operational for AFAS in response time (and status)  Time all subsystems fully operational for AFAS in warm status  Time all subsystems fully operational for AFAS in warm status  Time all subsystems fully operational for AFAS in fire (and status)  Time all subsystems fully operational for AFAS in fire (and status)  Time all subsystems fully operational for AFAS in fire (and status)  Time all subsystems fully operational for AFAS in fire (and status)  Time all subsystems fully operational for AFAS in fire (and status)  Time all subsystems fully operational for AFAS in fire (and status)  Time all subsystems fully operational for AFAS in fire (and status)  Time all subsystems fully operational for AFAS in fire (and status)  Time all subsystems fully operational for AFAS in fire (and status)  Time all subsystems fully operational for AFAS in fire (and status)  Time all subsystems fully operational for AFAS in fire (and status)  Time all subsystems fully operational for AFAS in fire (and status)  Time all subsystems fully operational fully operational fully fully fully fully fire (and status)  Time all subsystems fully operational fully ful	the first round is fired. The interval shall	time.	,	i	
the for AFAS in cold status and cold status the Mission cold status and the Mission Time all subsystems fully operational for AFAS in warm status the ced ctiles, it to the cold status the ced ctiles, it to the cold status the cold status and the cold status the cold status time all subsystems fully operational the ctiles, it to the cold status the cold status time all subsystems fully operational time and the cold status time and subsystems fully operational time and the cold status time and subsystems fully operational time and the cold status time and subsystems fully operational time and subsystems fully operated time	include the time required to emplace the		Mission	Time primary power applied to system (no	Event Report or Message PDUs
the Mission Time all subsystems fully operational Mission Time primary power applied to system (auxiliary response time for AFAS in warm status  ble Mission Time primary power applied to system (auxiliary power is running)  Time all subsystems fully operational	howitzer (emplacement being defined as all operations required to prepare for the mission		response time	auxiliary power running)	
the Mission Time primary power applied to system (auxiliary response time for AFAS in warm status Time all subsystems fully operational the ble ctiles, it one	beyond simply stopping) as well as on board		cold status	Time all subsystems fully operational	Event Report or Message PDUs
that the for AFAS in varm status the Live fire the ctiles, the cone of the cone of the cone of the characters and the cone of the characters are cone of the cone of the cone of the characters are cone of the co	fire control computations, regardless of the			: :	
the for AFAS in varm status Time all subsystems fully operational the ble Live fire Eed triles, at the fire the fire triles, at the fire triles, and the fire triles, at the fire fire triles, at the fire fire fire fire fire fire fire fir	mission.		Mission	Time primary power applied to system (auxiliary	Event Report or Message PDUs
the warm status Time all subsystems fully operational  ble Live fire ctiles, at the one one	NOTE: The specifications above imply that the		for AFAS in	/9	
ble zed zed one	time interval includes time required for		warm status	Time all subsystems fully operational	Event Report or Message PDUs
y y zed ctiles,	autoloading and crew interaction to fire the				,
y y zed ctiles, ut	mission as well as on-board fire control				
y y zed ctiles, ut					
y y zed zed ut ut one	Response time from cold start (non-				
y zed ctiles, ut	operational status, to fully mission capable status-15 minutes				
zed ctiles, ut one					
zed ctiles, vt one	response time from warm status to fully mission capable status-45 seconds			•	
provide for storage or no less than ou fuzed projectiles, and a usable quantity of liquid propellant corresponding to 75 percent of the top zone charge for a total quantity of 60 M549A1 projectiles and two M712 projectiles.	Ammunition Storage. The system shall	Live fire			
and a usable quantity of liquid propellant corresponding to 75 percent of the top zone charge for a total quantity of 60 M549A1 projectiles and two M712 projectiles.	provide for storage of no less trial of fuzed projectiles, two M712 Copperhead projectiles,				
corresponding to 75 percent of the top zone charge for a total quantity of 60 M549A1 projectiles and two M712 projectiles.	and a usable quantity of liquid propellant				
projectiles and two M712 projectiles.	corresponding to 75 percent of the top zone charge for a total quantity of 60 M549A1				
	projectiles and two M712 projectiles.				

Subject of Experimentation/Testing. AFAS Primary Armament

Specifications	Environments for Testing/	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate	Existing, Modified, or New DIS PDUs Required to Collect Data Elements
	Experimentation		Environment	(X = Uneupportable by DIS PDUs)
Automated Ammunition Access. Fuzed	Live fire for	sibility of	M712 Settings	NOTE: M712 is not a supported
projectifies and liquid propellant stored within		M712		munition type under DIS 2.03. An
the AFAS shall be automatically accessible by	automatically	projectifies		enumeration value for that entity
me system. The two M/12 projectiles may be manually accessed	accessed.	permit the		needs to be added.
	AFAS Simulator	accurately set	Time setting provided by RCC	Event Report
NOTE: Implied in the above specification is	with breech and	PRF code and		
that accessibility must allow the crew to set the	M712 projectiles for	time and	M712 time set by crew	Event Report
pulse repetition frequency (PRF) code and time	manual access and	manually load		
settings on the M712 projectile as well as load	loading.	the projectile	Observer's assigned PRF code	Signal PDU or Event Report
it. If the BCC automatically sends the designate		-		
command to the observer to provide the	Sensor(s) in Dreech		I'KF code set by crew.	Event Keport
during the last 13 seconds of the projectile's	code and time		Loading	
time of flight this design feature can also be	settings on M712	Timeliness of	0	
tested.	projectile.	designate	BCC indication that breech loaded and safe to fire	Event Report
		COMMand	Time	
			Time BCC acknowledged fire mission	Event Report
			Time BCC indicated that breech loaded and safe to fire	Event Report
-			Time of flight	Pire and Detonation PDUs
			Time AFAS sent designate command to FDC and/or observer.	Signal PDU
Manual Ammunition Access. When required	Live fire			
for maintenance or other operational reasons,				
ruzed projectives and liquid properlant shall be	Crew ammunicion			
of at least 130 complete rounds in less than 90	using AFAS			
minutes with the system in an unpowered	DEMVAL prototype			
state.				
Previously Rammed Round. Prior to	Live fire			
ehall check for a monitorialy sammed mand 16				
a round is found, the Primary Armament				
Subsystem shall notify the crew pending any				
further action. Primary Armament Subsystem				
shall be capable of hring a round rammed during a previous shot sequence.				
Bore Clear Check. Prior to ramming, the	Live fire			
Primary Armament Subsystem shall check to				
chairment the cannon bore is clear of				
The Primary Armament Subsystem shall check				
for a chambered projectile and debris which				
could cause a sticker.				

Subject of Experimentation/Testing. AFAS Primary Armament

Specifications	Environments for Testing/ Experimentation	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Eticing, Modified, or New DIS PDUs Required to Collect Data Blements (X = Unsupportable by DIS PDUs)
Fuze Setting. Electronic fuze setting shall be accomplished. Projectiles equipped with non-electronically set fuzes, such as M739A1(point detonating/delay), shall be preset prior to uploading into the howitzer. Copperhead fuze shall be manually set prior to ramming. Prior to ramming the Primary Armament Subsystem shall automatically set electronic fuzes for the projectiles that possess them. Timing of this event in the ammunition handling cycle shall not inhibit the ability of the system to perform round-to-round to tractions via the fuze setting.	Live fire. For Copperhead. See Automated Ammunition Access above			
Confirmation of Fuzed Projectile. Prior to ramming any projectile, the system shall automatically verify the projectile/fuze coding matches the projectile/fuze designated by the fire control solution.	Live fire			
Projectile Ramming. The Primary Armament Subsystem shall be capable of automatically ramming fuzed projectiles into the forcing cone of the cannon without affecting the functional integrity of the projectile and fuze. The ram shall be sufficient to obviate fall back. The M712 Copperhead may be manually rammed.	Live fire			
Propellant Loading. All propellant handling functions necessary to fire the cannon shall be automated.	Live fire			
Verification of Projectile Firing. For each round fired, the Primary Armament Subsystem shall verify that the projectile has left the gun tube prior to ending the mission after the last round in a given mission is fired.	Live fire			
Gun Swabbing. It required, the Primary Armament Subsystem shall automatically swab the gun after firing. Gun Positioning. The primary armament subsystem shall be capable of elevating the gun	Live fire Verify with DEMVAL prototype		-	
Perween -3 and 73 degrees elevation with respect to the platform.  Misfire Procedures. The primary armament subsystem shall have crew misfire procedures, and crew and DD personnel procedures for extraction of stuck rounds.	Verify in AFAS operator manual and appropriate support maintenance manuals. Inspect projectile extraction tools.			

Subject of Experimentation/Testing. AFAS Primary Armament

Charliffeeblane	Caulman and for	7	7	
	Totaline 101	_	Call and a fight of the state o	Monthly monther, or new U.S r.U.S.
	Experimentation		Conclude it 1715 virtue summon is Appropries	(X = Unsupportable by DIS PDUs)
em	Live fire	Sensor	Type of self defense sensor activated	Event Report PDU
shall be capable of supporting the direct fire		activation		•
mission.	Simulator that			
	provides sensor	Detection to	Time	
nting	warnings and a	firing time		
	direct fire sighting	,	Time sensor activated alerting AFAS crew '	Event Report PDU
rense suite	and firing capability			i
may be tied into the experiment.	to the gunner		Time AFAS fires direct fire mission	The PDC
	planned for AFAS.	Engagement	Location	
		range and		706
		impact	ring vence	Detonation PDO
			Target vehicle	Detonation PDU
			Location of ordnance impact if target vehicle engaged but not hit.	Detonation PDU
		Type projectile	Type projectile Projectile type and number fired	Fire and Detonation PDUs
		fired		
		Outcome of	Effects on AFAS and target vehicle	
		engagement	Vehicle and force identification	Detonation PDU
			Operational vehicles	Entity State PDU
			Mobility kills	Entity State PDU
	-		Fire control kills	Entity State PDU
			Communication kills	Receiver PDU
			Area visually obscured	Britity State PDU

## Subject of Experimentation/Testing. AFAS Primary Armament

- 2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment.
- Specifications supportable by DIS. Based on the results derived from the above matrix, DIS experimentation/testing appears feasible to assess the operational and technical tradeuffs in AFAS specifications addressing the following areas:
- Response time with single and mixed projectile types
- Rates of fire with single and mixed projectile types
- MRSI time of impact with single and mixed projectile types
- Effectiveness of indirect fire engagements involving serial and MRSI fire missions
- Manual access of M712 Copperhead projectile
- Direct fire
- 2.2 Sample Experiment. A single experiment/scenario in the DIS virtual environment can address each of the specifications and other aspects of performance outlined above. Analysis testers can run the same experiment repeatedly altering designs to determine operational and technical tradeoffs offered by alternative crew station configurations, soldier-machine interfaxes time and rate of fire requirements may be determined. Installation of an actual BCC prototype in the AFAS simulator provides the opportunity to experiment with various SMIs and BCC system and software design architecture's to determine the best fit to meet overall response time and rate of fire requirements. Placing the AFAS simulator on a combined arms virtual battlefield dues permit validations of firing accuracy to the degree specified in the AFAS specification. However, the overall impact of design changes can be measured in terms of the battle outcomes at the (SMIs), BCC designs, and autoloading designs/times. For example if APAS simulator software has a selectable autoloading time, the impact of various autoloading designs on overall response conclusion of the experiment/scenario. Listed below are example battle statistics that testers/analysts may derive from the data elements in the above matrix to correlate experiment results to design changes:
- Number of threat entities destroyed by AFAS indirect or direct fire by projectile type
- Number of threat entities damaged by AFAS indirect fire or direct fire by projectile type
- Number of threat entities blinded by AFAS smoke missions by indirect or direct fire
- Number of threat entities illuminated by AFAS illumination missions
- Number of missions fired
- Number of projectiles fired by type
- · Highest number of projectiles fired by type by minute for a duration of 3 minutes or longer
- Number of MRSI missions fired
- Number of MRSI projectiles fired by type, mission and range
- Mission response time by mission for AFAS while emplaced
- Mission response time by mission for AFAS while moving
- Mission response time by mission for senior AFAS while emplaced
- Mission response time by mission for senior AFAS while moving
- · Time span for impact of all MRSI rounds by mission and range

## Subject of Experimentation/Testing. AFAS Primary Armament

- Time to process and fire M712 Copperhead by round and mission
- To support experimentation and testing in the areas identified above the following resources are required: 3. Required Resources.
- One AFAS crew to man an AFAS simulator
- One AFAS simulator equipped with BCC, radios, modems, crew stations, crew displays, supporting software, with access to M712 Copperhead rounds in the ammunition storage area
- One FARV simulator and crew or FARV SAFOR and SAFOR controller to support resupply operations. Fire Support Automated Test System (FSATS) could be upgraded to support digital messaging from a SAFOR FARV to an AFAS manned simulator during docking operations to coordinate and control ammunition and fuel transfer
- One LRP SAFOR and LRP controller to support FARV upload/download operations.
- One AFAS SAFOR and SAFOR controller to support senior to subordinate AFAS operations. FSATS could be upgraded to support digital messaging from a SAROR Subordinate AFAS to a Senior AFAS manned simulator to support senior/subordinate howitzer operations.
- One observer to acquire and submit calls for fire to engage opposition force targets on the virtual battlefield. FSATS could be employed as an alternative to generate calls for fire that drive a highly controlled scenario.
- One AFATDS POC computer operator to process the observer's call for fire. Another alternative is to upgrade PSATS POC node so that the PSATS POC may interface with AFAS and FARV crews to interact with PSATS message traffic generated by the POC or observer nodes as appropriate.
- Threat SAFOR operations order and controller to execute order.
- Friendly force operations order with fire support coordination measures and battlefield geometry and controller to execute order.

Subject of Experimentation/Testing: AFAS Secondary Armament

	u	Performance	Collection if DIS Virtual Simulation is Appropriate Environment	Externity, modified, or New DIS TOUS Requires to Collect Data Elements  (X = Unsupportable by DIS PDUs)
Decision Aids. The AFAS must have an embedded decision aid capability to assist the	Live or Virtual		Capability	
crewmen making decisions associated with planning, monitoring and executing system		Percent of planning	Number of survivability plans determined with Decision Aids	Event Report PDU
		done with Decision	Number of survivability plans determined without Decision Aids	Event Report PDU
		Aids	Crew comments on survivability plans determined with and without Decision Aids	×
		Percent of	Number of monitoring actions conducted with	Event Report PDU
		monitoring done with	Decision Aids Number of monitoring actions conducted	Event Report PDU
	,	Decision Aids	without Decision Aids  Crew comments on monitoring actions	×
			conducted with and without Decision Aids	
		Percent of	Number of survivability actions executed with	Event Report PDU
		done with	Number of survivability actions executed	Event Report PDU
		Decision	without Decision Aids	
		Aids	Crew comments on survivability actions executed with and without Decision Aids	×
Survivability Subsystem. The Survivability	Live or Virtual		Time	
measures related to protecting the AFAS		Average	Time passive measure implemented	Event Report or Electromagnetic Emissions PDU
crew and hardware systems. It interfaces heavily with all other subsystems.		time passive measures	ime passive measure completed Passive measure implemented	Event Report of Electromagnetic Emissions (100) Event Report or Electromagnetic Emissions PDU
		activated		
		Average time active	Time active measure implemented	Event Report or Electromagnetic Emissions PDU
		measures activated	Time active measure completed Active measure implemented	Event Report or Electromagnetic Emissions PDU Event Report or Electromagnetic Emissions PDU

Subject of Experimentation/Teating: AFAS Secondary Armament

Eirepower (Defensive). The system	Testing/ Experimentation	Performance	Collection if DIS Virtual Simulation is Appropriate Environment	Collect Data Elements (X = Unsupportable by DIS PDUs)	
	Live or Virtual		Capability		
suppression and defensive capability employable against threat ground forces,		Percent of effective	Number of target engagements Number of targets defeated	Event Report PDU Entity State PDU	
helicopters, reconnaissance vehicles and other lightly armored targets that fall within		engage- ments with	Type of force/vehicle engaged Range at which target was engaged	Event Report PDU Entity State PDU Entity State PDU	
ciose-combat range.		armament	Engagement with primary or secondary armament	Event Report TDO	
			Effectiveness		
		Effective-	Number of rounds/missiles fired	Fire PDU	
		ness of	Number of target hits	Detonation PDU	
		secondary	Range at which target hits occurred Type of force/vehicle engaged	Fire and Detonation PDU Entity State PDU	_
1	Live or Virtual		Capability		
armament for the system snail be a combat instrument capable of engaging targets at			Minimum effective and safe range		
close combat range.			Maximum effective range		
			Maximum sustained rate of fire		
			Maximum rate of fire	. !	
			Number of on-board rounds/missiles	Event Report PDU	
			Range		
		Average engagement	Distance at which target first engaged Distance at which target defeated or disengaged	Entity State PDU Entity State PDU	
		28.18.	· ·		
			Time engagement stopped Time engagement started	Event Report PDU Event Report PDU	

Subject of Experimentation/Testing: AFAS Secondary Armament

Specifications	Environments for Testing/Experimentation	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Elements (X = Unsupportable by DIS PDUs)
Safety.	Live or Virtual		Capability	
Firing the defensive weapon shall not introduce toxic products into the crew compartment in concentrations that exceed OSHA established limits.		Percent of warnings related to firing secondary armament	Record of firing the secondary armament Record of warnings attributed to firing the secondary armament Vehicle ID number	Fire PDU  Event Report PDU  Entity State PDU
The C3 Subsystem shall include capabilities to support the crew in monitoring system safety status.			Record of operator monitoring of safety status actions Record of operator safety status actions taken Reason for taking action	Event Report PDU Event Report PDU Event Report PDU
The system shall provide both audible and visible warnings to alert the crew to internal and external hazardous situations, e.g., fire, NBC contamination, LP spills, and vehicle backing up. These warnings shall not interrupt mission critical functions or create unsafe situations in tactical environments.			Number of warnings to alert crew Type of alert (audible, visual or both) Reason for warning Number of warnings that interrupted mission critical functions	Event Report PDU Event Report PDU Event Report PDU Event Report PDU
Power.	Live and Virtual		Capability	
The AFAS must be able to produce a reduced level of power which is capable of powering on-board computer, communications, position/navigation and survivability systems (less main armament and NBC overpressure) and starting the engine for at least 6 hours.			Record of reduced power operations of the survivability subsystem Record of reduced power operations for the survivability sensors systems	X (Generally, these data elements are not available in the normal DIS PDU stream. However, they could be made available through custom Event Report PDUs.)
		Median Time Reduced Fower Level Operations were	Time reduced power level operations stopped Time reduced power level operations initiated Record of reduced power level operations Reason for reduced power level operations	X (Generally, these data elements are not available in the normal DIS PDU stream. However, they could be made available through custom Event Report PDUs.)

Subject of Experimentation/Testing: AFAS Secondary Armament

Specifications	Environments for Testing/	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Elements  (X = Unsupportable by DIS PDUs)
Identification Friend or Foe (IFF). The C3	Live or Virtual		Capability	
Combat Identification System procedures and equipment to reduce the potential for			Record of BCIS use Problems encountered with IFF identification	Event Report PDU Event Report PDU
fratricide.			Accuracy	
		Percent correct IFF	Number of IFP queries Number of IFF successful replies	Signal PDU Signal PDU
		replies		

## Subject of Experimentation/Testing: AFAS Secondary Armament

selection of alternative technologies could also be made in the areas of effectiveness, efficiency, survivability ratios and hit probabilities. The technical characteristics of each weapon operator controls/displays. Assessment of the adequacy, maturity and compatibility of the secondary armament system to defeat threat targets could be made. The evaluation and secondary armament weapon capabilities. The system could be looked at for integration of automation, ammunition storage capacity, self-defense decision aid execution and 2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment. A DIS Virtual Environment would allow demonstration and evaluation of various system could be assessed in terms of rates of fire, effective ranges and probability of hit and kill in an operational environment.

#### 2.1 Stated specifications:

- Decision Aids
- Survivability Subsystem
  - Firepower (Defensive)
- Defensive Armament
- Identification Friend or Foe (IFF)

## : Other Aspects of Performance Measurable in a DIS Virtual Environment. None

could be gathered and the results assessed by different type of secondary armament system employed to determine the best solution to the secondary armament weapon. This sequence of events or could evaluate the overall impact on system and crew's capability to meet battlefield, system and secondary armament system requirements. Placing the AFAS simulator on a combined arms or virtual battlefield may not permit validations of some aspects as specified in the AFAS specification. However, the overall impact of design capabilities can be measured in terms of the battle For example if the scenario contains threat air and ground forces, AFAS engagement of these systems could occur. Crew reactions, crew tasks, timeline analysis, weapon engagements and results outcomes at the conclusion of the experiment/scenario. Listed below are example battle statistics and conclusions that testers/analysts may derive from the data elements in the above matrix to 2.3 Sample Experiment. A single experiment/scenario in the DIS virtual environment can address each of the specifications and other aspects of performance outlined above. Analyst and testers can run the same experiment repeatedly altering or invoking system capabilities. The experiments should be run against approved Training and Doctrine Command (TRADOC) scenarios appropriate to the AFAS System Threat Assessment Report (STAR) and at combat tempo in accordance with the approved Operational Mode Summary/Mission Profile (OMS/MP) correlate experiment results to design capabilities and/or changes:

- Ranges for engagement of threat targets
  - Effectiveness of engagements
- Survivability of the AFAS following ground engagement
  - Survivability of the AFAS following air engagement
    - Effectiveness of active and passive measures
      - Reduction of fratricide instances
- Effectiveness of Decision Aids to increase system survivability
- Effectiveness of multiple engagements when operating under single. paired and pooled operations

## To support experimentation and testing in the areas identified above the following resources are required: 3. Required Resources.

- One AFAS crew to man an AFAS simulator
- One AFAS simulator equipped with BCC, radios, modems, crew stations, crew displays, supporting software
- · One observer to acquire and submit calls for fire to engage opposition force targets on the virtual battlefield.
  - One fire direction computer operator
- One AFATDS POC computer to process the observer's call for fire during centralized AFAS operations, automatically relay calls for fire during decentralized operations, and update FARV information base on LRP locations, resupply requests and operations and battlefield information.
  - Three AFAS and three FARV SAFOR to support paired and pooled self-defense operations
- Friendly force operations order with fire support coordination measures and battlefield geometry
  - Friendly SAFOR to execute the order
- Threat ground and air vehicles and systems to conduct target engagements
  - A Time Ordered Events List (TOEL)

Subject of Experimentation/Testing: FARV Secondary Armament

Specifications	Environmente for	Meseures of	Characteristics and Their Data Flements for	Brieting Madified or New DIS PDI le Beamand la
	Teating/	Performance	Collection if DIS Virtual Simulation is	Collect Data Elements
	Experimentation		Appropriate Environment	(X = Unsupportable by DIS PDUs)
Decision Aids. The FARV must have an embadded decision aid canability to seste the	Live or Virtual		Capability	
crewmen making decisions associated with		Percent of	Number of survivability plans determined with	Event Report PDU
Planning, monitoring and executing system		planning	Decision Aids	•
survivability.		done with	Number of survivability plans determined	Event Report PDU
		Decision	without Decision Aids	
		Aids	Crew comments on survivability plans	×
			determined with and without Decision Aids	
		Percent of	Number of monitoring actions conducted with	Event Report PDU
		monitoring	Decision Aids	
		done with	Number of monitoring actions conducted	Event Report PDU
		Decision	without Decision Aids	
		Aids	Crew comments on monitoring actions	×
			conducted with and without Decision Aids	
		Dendert of	All the best state of the state	Total Process
		ovecution	Indiable of our traduing actions executed with	Eveni nepon 1 20
		describer.	Minter of martinetility antique of the second	
		done with	Number of survivability actions executed	Event Report 1'DU
		Decision	without Decision Aids	
		Aids	Crew comments on survivability actions	×
			executed with and without Decision Aids	
Survivability Subsystem. The Survivability	Live or Virtual		Time	
measures related to protecting the FARV		Average	Time nassive measure implemented	Event Report or Electromagnetic Emissions PDI
grow and hardware systems. It interfaces		time nassive	Time nassive measure completed	Fvent Report or Flectromagnetic Emissions PDI
heavily with the MMCS, and to differing		measures	Passive measure implemented	Event Report or Electromagnetic Emissions PDU
extents, with all other subsystems.		activated		
		Average		
		time active	Time active measure implemented	Event Report or Electromagnetic Emissions PDU
		measures	time active measure completed Active measure implemented	Event Report of Electromagnetic Emissions PUU  Event Report of Electromagnetic Emissions PDU
				-

Subject of Experimentation/Testing: FARV Secondary Armament

Specifications	Environments for Testing/	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Elements (X = Unsupportable by DIS PDUs)
Firepower (Defensive). The system defensive armament shall provide for area	Live or Virtual		Capability	
suppression and defensive capability employable against threat ground forces,		Percent of effective	Number of target engagements Number of targets defeated	Event Report PDU Entity State PDU
helicopters, reconnaissance vehicles and other lightly armored targets that fall within close-combat range.		engage- ments with secondary	Type of force/vehicle engaged Range at which target was engaged Engagement with primary or secondary	Event Report PDU Entity State PDU Event Report PDU
			armament	
			Effectiveness	
		Effective-	Number of rounds/missiles fired	Fire PDU
		secondary	Number of target nits Range at which target hits occurred	Detomation PDU Bire and Detomation PDI
		armament	Type of force/vehicle engaged	Entity State PDU
Defensive Armament. The defensive armament for the system shall be a combat	Live or Virtual		Capability	
instrument capable of engaging targets at			Minimum effective and safe range	
cuse combat range.			Maximum enective range Maximum enetained rate of fire	
			Maximum rate of fire	
			Number of on-board rounds/missiles	Event Report PDU
			Range	
		Average engagement range	Distance at which target first engaged Distance at which target defeated or disengaged	Entity State PDU Entity State PDU
			Time	
			Time engagement stopped Time engagement started	Event Report PDU Event Report PDU

Subject of Experimentation/Testing: FARV Secondary Armament

Capability  Second of firing the secondary armament  Record of warnings attributed to firing the secondary armament  Record of warnings attributed to firing the secondary armament  Record of operator monitoring of safety status actions  Record of operator safety status actions taken  Reason for taking action  Number of warnings to alert crew  Reason for warnings that interrupted mission critical functions  Number of warnings that interrupted mission critical functions  Record of reduced power operations of the survivability subsystem  Record of reduced power level operations stopped  Time reduced power level operations initiated  Time reduced power level operations  Reason for reduced power level operations  Record of BCIS use  Problems encountered with IFF identification  Accuracy  Number of IFF queries  Number of IFF queries  Number of IFF queries	Specifications	Environments for	Measures of	Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs Required to
Capability  Creed  Avarnings  Record of firing the secondary armament  Find  Freed of Operator and Free E  Record of operator monitoring of safety status  Freed of Operator and Prints  Freed of Operator monitoring of safety status  Freed of Operator safety status actions taken  Freed Operator of Taking action  Freed Operator of Taking action  Freed Operator of Taking action  Freed Operator of Trime  Time Freed Operations of the survivability sensors systems  Freed Operations  Freed Operation		Testing/ Experimentation	Performance	Collection if DIS Virtual Simulation is Appropriate Environment	Collect Data Elements (X = Unsupportable by DIS PDUs)
Percent of Record of firing the secondary armament Freed reduced to firing the secondary armament firing secondary armament firing secondary armament firing secondary armament Freedord of operator safety status actions actions actions actions actions actions actions actions actions action from the Freedord of operator safety status actions actions action and Reason for taking action in Reason for taking action in Reason for taking action in Freedord of operator safety status actions taken be reason for taking action in Freedord in Freedord of Papablity actions in Papablity in Freedord of reduced power operations for the survivability sensors systems  Median Time Record of reduced power level operations initiated a survivability sensors systems  Median Time Freduced Record of reduced power level operations initiated and Power Level Record of reduced power level operations initiated and Problems encountered with IFF identification and Record of BCIS use Percent Number of IFF queries SS Scorect IFF Number of IFF queries SS Scorect IFF Number of IFF auccessful replies SS SS Conducted Freedord of Papablity Number of IFF queries SS SS Conducted Freedord Number of IFF qu	Safety. Firing the defensive weapon shall not introduce toxic products into the crew	Live or Virtual			
telated in the secondary arrament fining secondary arrament fining secondary arrament secondary second of reduced power operations of the survivability sensors systems are conducted second of reduced power level operations inhisted as the second of reduced power level operations inhisted second of reduced power level operations inhisted second of reduced power level operations are conducted second of second secon	compartment in concentrations that exceed		Percent of	Record of firing the secondary armament	Fire PDU
stem  armament  Record of operator monitoring of safety status  artions  Reason for taking action  Reason for warnings to alert crew  Type of alert (audible, visual or both)  Reason for warnings that interrupted mission  Capability  Record of reduced power operations of the  survivability subsystem  Amedian  Time  Number of reduced power level operations initiated  Reduced  Reduced  Time reduced power level operations initiated  Power Level  Conducted  Record of reduced power level operations  Resond of reduced power level operations  Were  Conducted  Capability  Record of Reduced power level operations  Reason for reduced power level operations  Reason for reduced power level operations  Record of Reduced  Time reduced power level operations  Reason for reduced power level operations  Conducted  Capability  Record of Reduced  Record of Reduced power level operations  Reason for reduced power level operations  Reason for reduced power level operations  Reason for reduced power level operations  Conducted  Capability  Record of IFF queries  Signatures  Record of IFF queries			related to	secondary armament	באבוו ויבלים ו בס
Record of operator monitoring of safety status actions taken actions articles Reason for taking action  Reason for taking action  Reason for warnings to alert crew  Type of alert (audible, visual or both)  Reason for warnings that interrupted mission chickles and Virtual  Capability  Record of reduced power operations of the survivability subsystem  Record of reduced power operations for the survivability sensors systems  Time  Accuracy  Accuracy  Accuracy  Accuracy  Accuracy  To reduced power level operations  Toperations  Toperations  Toperations  Toperations  Toperations  Toperations  Toperations  Toperations  Time  Tim	The C3 Subsystem shall include capabilities to support the crew in monitoring system safety status.		firing secondary armament	Vehicle ID number	Entity State PDU
Accuracy  Time  Median  Time  Median  Time  Median  Time  Median  Time  Median  Time  Capability  Record of preduced power level operations studied all for live or Virtual  Median  Time  Median  Media				Record of operator monitoring of safety status	Event Report PDU
he and he				actions Record of operator safety status actions taken	Event Report PDU
Number of warnings to alert crew  t recate  Type of alert (audible, visual or both)  Reason for warning  Type of alert (audible, visual or both)  Reason for warning  Number of warnings that interrupted mission  Capability  Record of reduced power operations of the survivability subsystem  Median  Time  Time  Reason for reduced power operations for the survivability sensors systems  Time reduced power level operations initiated a Time  Reason for reduced power level operations initiated a Time  Reason for reduced power level operations  Conducted  Reason for reduced power level operations  Record of BCIS use  Percent  Number of IFF queries  Signature  Accuracy  Accuracy  Number of IFF queries  Signature  Number of IFF queries	The system shall provide both audible and			Reason for taking action	Event Report PDU
r create  Reason for warning  Reason for warning  Reason for warning  Record of reduced power operations of the survivability subsystem  Median  Time  Median  Time reduced power level operations initiated and Power Level  Record of reduced power level operations initiated and Power Level  Record of reduced power level operations initiated and Power Level  Record of reduced power level operations initiated and Power Level  Record of reduced power level operations initiated and Power Level  Record of reduced power level operations initiated and Record of reduced power level operations  Reason for reduced power level operations  Were  Conducted  Capability  Record of BCIS use  Problems encountered with IFF identification  Record of BCIS use  Problems encountered with IFF identification  Record of IFF queries  Somitizes  Number of IFF queries  Somitizes	visible warnings to alert the crew to internal and external hazardous situations. e.g., fire.			Number of warnings to alert crew	Event Report PDU
rectate  Reason for warnings that interrupted mission E critical functions  Capability  Record of reduced power operations of the survivability subsystem  Record of reduced power operations for the survivability sensors systems  Median  Time  Reduced power level operations stopped Time reduced power level operations of the survivability sensors and reduced power level operations of the survivability sensors and reduced power level operations of the survivability sensor for reduced power level operations of Reduced Time reduced power level operations of Record of BCIS use Problems encountered with IPF identification  Accuracy  Accuracy  Number of IFF queries  Signature of IFF queries  Number of IFF queries  Signature of IFF queries  Number of IFF queries  Signature of IFF queries  Signature of IFF queries  Number of IFF queries	NBC contamination, LP spills, and vehicle			Type of alert (audible, visual or both)	Event Report PDU
Live and Virtual  Capability  Record of reduced power operations of the survivability subsystem  Record of reduced power operations for the survivability sensors systems  Median  Time Time Reduced Time reduced power level operations stopped Time reduced power level operations initiated and Power Level Reduced Power Level Record of reduced power level operations initiated and Power Level Record of reduced power level operations initiated and Power Level Record of Reduced power level operations initiated and Record of Record of reduced power level operations  Accuracy  Accuracy  Number of IFF queries  Signory  Accuracy  Accuracy  Number of IFF queries  Signory  Accuracy  Accuracy  Number of IFF queries	backing up. These warnings shall not interrupt mission critical functions or create			Reason for warning  Number of warnings that interrupted mission	Event Report PDU Event Report PDU
Live and Virtual  Record of reduced power operations of the survivability subsystem  Record of reduced power operations for the the survivability sensors systems  Time Reduced power level operations stopped Time reduced power level operations initiated appearations of reduced power level operations operations were Conducted Reason for reduced power level operations were Conducted Capability  Record of reduced power level operations initiated appearations of reduced power level operations of reduced power level operations of Reason for reduced power level operations of Reason for reduced power level operations of the Record of Re	unsafe situations in tactical environments.			critical functions	
Record of reduced power operations of the survivability subsystem  Record of reduced power operations for the survivability sensors systems  Median Time Record of reduced power level operations stopped Time reduced power level operations initiated Power Level Power Level Power Level Operations initiated Record of reduced power level operations were  Conducted Capability  Record of BCIS use Problems encountered with IFF identification  Accuracy  Percent Number of IFF queries Signatures  Number of IFF queries		Live and Virtual		Capability	
Record of reduced power operations for the survivability sensors systems  Median Time Time Reduced Time Time reduced power level operations stopped Reduced Time reduced power level operations initiated Power Level Record of reduced power level operations Were Conducted Capability  Record of BCIS use Problems encountered with IFF identification  Accuracy  Percent Number of IFF queries Samples	The FARV must be able to produce a reduced level of power which is capable			Record of reduced power operations of the survivability subsystem	X (Generally, these data elements are not available in the normal DIS PDU stream. However,
Median Time Time reduced power level operations stopped Reduced Reduced Power Level Power Level Coperations Were Conducted Capability d Record of BCIS use Percent Record of IFF queries Conducted Capability Accuracy Record of IFF queries SS	of powering on-board computer, communications, position/navigation			Record of reduced power operations for the survivability sensors systems	they could be made available through custom Event Report PDUs.)
Median Time reduced power level operations stopped Reduced Reduced Power Level Record of reduced power level operations Operations Were Conducted Capability Id Record of BCIS use Froblems encountered with IFF identification Reason for reduced power level operations Froblems encountered with IFF identification Record of BCIS use Percent Accuracy Record of IFF queries Formations Reason for reduced power level operations Froblems Record of BCIS use Froblems Froble	and survivability systems (secondary armament and NBC overpressure) and				
Time reduced power level operations stopped Reduced Time reduced power level operations initiated all Power Level Record of reduced power level operations were Conducted Capability  Live or Virtual Capability Record of BCIS use Problems encountered with IFF identification B Accuracy  Percent Number of IFF queries SS correct IFF Number of IFF successful replies SS correct IFF Number of IFF successful replies SS	starting the engine for at least 6 hours.		Median	Time	
Power Level Record of reduced power level operations Were Conducted Capability Record of BCIS use Problems encountered with IFF identification Accuracy Percent Number of IFF queries Correct IFF Number of IFF successful replies			Time Reduced	Time reduced power level operations stopped Time reduced power level operations initiated	X (Generally, these data elements are not available in the normal DIS PDU stream. However,
Live or Virtual  Capability  Record of BCIS use Problems encountered with IFF identification  Accuracy  Percent Number of IFF queries  correct IFF Number of IFF successful replies			Power Level Operations were	Record of reduced power level operations Reason for reduced power level operations	they could be made available through custom Event Report PDUs.)
Record of BCIS use Problems encountered with IFF identification Accuracy Percent Number of IFF queries correct IFF Number of IFF successful replies	Identification Friend or Foe (IFF). The C3	Live or Virtual	Conducted	Capability	
Percent Number of IFF queries correct IFF Number of IFF successful replies	Combat Identification System procedures and equipment to reduce the potential for			Record of BCIS use Problems encountered with IFF identification	Event Report PDU Event Report PDU
Number of IFF queries IFF Number of IFF successful replies				Accuracy	
ונלחונס			Percent correct IFF replies	Number of IFF queries Number of IFF successful replies	Signal PDU Signal PDU

## Subject of Experimentation/Testing: FARV Secondary Armament

operator controls/displays. Assessment of the adequacy, maturity and compatibility of the secondary armament system to defeat threat targets could be made. The evaluation and selection of alternative technologies could also be made in the areas of effectiveness, efficiency, survivability ratios and hit probabilities. The technical characteristics of each weapon secondary armament weapon capabilities. The system could be looked at for integration of automation, ammunition storage capacity, self-defense decision aid execution and 2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment. A DIS Virtual Environment would allow demonstration and evaluation of various system could be assessed in terms of rates of fire, effective ranges and probability of hit and kill in an operational environment.

#### 2.1 Stated specifications:

- Decision Aids
- Survivability Subsystem
  - Firepower (Defensive)
- Defensive Armament
- Identification Friend or Foe (IFF)

## 2.2 : Other Aspects of Performance Measurable in a DIS Virtual Environment. None

For example if the scenario contains threat air and ground forces, FARV engagement of these systems could occur. Crew reactions, crew tasks, timeline analysis, weapon engagements and results to could be gathered and the results assessed by different type of secondary armament system employed to determine the best solution to the secondary armament weapon. This sequence of events could evaluate the overall impact on system and crew's capability to meet battlefield, system and secondary armament system requirements. Placing the FARV simulator on a combined arms Society state of design capabilities can be measured in terms of the battle Solutions of some aspects as specified in the FARV specification. However, the overall impact of design capabilities can be measured in terms of the battle outcomes at the conclusion of the experiment/scenario. Listed below are example battle statistics and conclusions that testers/analysts may derive from the data elements in the above matrix to 2.3 Sample Experiment. A single experiment/scenario in the DIS virtual environment can address each of the specifications and other aspects of performance outlined above. Analysis and testers can run the same experiment repeatedly altering or invoking system capabilities. The experiments should be run against approved Training and Doctrine Command (TRADOC) scenarios appropriate to the FARV System Threat Assessment Report (STAR) and at combat tempo in accordance with the approved Operational Mode Summary/Mission Profile (OMS/MP). correlate experiment results to design capabilities and/or changes:

- Ranges for engagement of threat targets
  - **Effectiveness of engagements**
- Survivability of the FARV following ground engagement
  - Survivability of the FARV following air engagement
    - Effectiveness of active and passive measures
    - Reduction of fratricide instances
- Effectiveness of Decision Aids to increase system survivability
- Effectiveness of multiple engagements when operating under single. paired and pooled operations

# 3. Required Resources. To support experimentation and testing in the areas identified above the following resources are required:

- One FARV crew to man an FARV simulator
- One FARV simulator equipped with radios, modems, crew stations, crew displays, supporting software
- One observer to acquire and submit calls for fire to engage opposition force targets on the virtual battlefield.
- One fire direction computer operator
- One APATDS POC computer to process the observer's call for fire during centralized AFAS operations, automatically relay calls for fire during decentralized operations, and update FARV information base on LRP locations, resupply requests and operations and battlefield information.
  - Four AFAS and three FARV SAFOR to support paired and pooled self-defense operations
- Priendly force operations order with fire support coordination measures and battlefield geometry
  - Priendly SAFOR to execute the order
- Threat ground and air vehicles and systems to conduct target engagements
  - A Time Ordered Events List (TOEL)

Subject of Experimentation/Teating: AFAS Decision Aid-Fire Mission Processing

Edisting, Modified or New DIS PDUs Required to Cellect Data Elements (X=Unsupportable by DIS PDUs)	Hire PDU or Signal PDU (MPRs)	Signal PDU	Signal PDU	Fire PDU and Event report PDU		Fire PDU or Signal PDU (MFRs)	Signal PDU	Signal PDU	Fire PDU and Event report PDU	Event report PDU	Event report PDU
Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment											
Measures of Performance	Total number of rounds fired, with and without DA	Total number of fire missions returned as unsupportable to the Platoon Operations Center (POC), with and without DA	Number of fire missions returned as unsupportable to the POC for insufficient appropriate ammunition, with and without DA	Time fired and sequence of missions fired with fire order components listed, with and without DA	For each mode of operation:	Total number of rounds fired, with and without DA	Total number of fire missions returned as unsupportable to the Platoon Operations Center (POC), with and without DA	Number of fire missions returned as unsupportable to the POC for insufficient appropriate ammunition, with and without DA	Time fired and sequence of missions fired with fire order components listed, with and without DA	Total time required to execute each fire mission while in position, with and without DA	Total time required to execute each fire mission while moving, with and without DA
Environments for Testing/ Experimentation	Virtual or Live				Virtual or Live						
Specifications	Firepower. The AFAS will provide responsive indirect fire to the maneuver forces. High speed automated firing data computation.	advanced propulsion technology, and automated ammunition handling, loading and firing will enable the AFAS to deliver massive	and precise firepower as part of coordinated unit missions or independent single howitzer missions. The Fire Mission Processing (FMP) Decision Aid (DA) manages the AFAS ballistic computation component (BCC), providing fire	missions to the BCC from a prioritized, time- sequenced mission queue. Therefore, the measures of performance do not address the technical fire control issues or compliance with Fire Support Coordination Measures, both tasks belonging to the BCC.	Command, Control and Communications (C3). Virtual or Live The system shall be canable of centralized.	decentralized and senior/subordinate modes of operation.					

Subject of Experimentation/Testing: AFAS Decision Aid-Fire Mission Processing

cs and Existing Modified or New DIS  rments PDUs Required to Collect Data if DIS Elements (X=Unsupportable by ntion is nte	ution X Mal	Hire PDU or Signal PDU (MPRs)	Signal PDU	Signal PDU	Fire PDU and Event report PDU	Event report PDU	Event report PDU
Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Time Command execution speeds Accuracy Correct operational sequencing		<u>.</u>				
Measures of Performance	Accuracy	Total number of rounds fired, with and without DA	Total number of fire missions returned as unsupportable to the Platoon Operations Center (POC), with and without DA	Number of fire missions returned as unsupportable to the POC for insufficient appropriate ammunition, with and without DA	Time fired and sequence of missions fired with fire order components listed, with and without DA	Total time required to execute each fire mission while in position, with and without DA	Total time required to execute each fire mission while moving, with and without
Environments for Testing/ Experimentation	Live	Virtual or Live					
Specifications	Training. Crew training level can be evaluated Virtual or by tracking individual speed and accuracy in executing the commands and other functions associated with proper operation of the FMP decision aid. Accuracy is a function of executing the commands in the proper sequence.	Responsiveness. Though the AFAS is always available to shoot fire missions in support of	the maneuver commander, i.e., while on the move or emplaced, the system's responsiveness is affected by the crew's ability to respond rapidly to the next priority mission	request. The required response time while in position is within 20 seconds; the response time while moving is within 45 seconds.			

- Technical and Operational Benefits of Experimentation in DIS Virtual Environment. Though decision aids are no longer considered a high-risk technology by military leaders, they still need to quantify the operational benefit of various decision-aid prototypes to justify the research and development expense associated with them. Both virtual and live simulations opportunity for side-by-side comparison testing of crews with and without these devices. The integration of decision aids also permits early soldier/user input as to how decision-aid performance might be improved. Ultimately, crews can be trained to better use fielded decision aids.
   Required Resources. Decision-aid prototypes and interfaces, test and evaluation software to track decision-aid times and other variables, and, perhaps, video equipment to monitor crew performance.

Subject of Experimentation/Testing: AFAS Decision Aid-Reconnaissance, Selection and Occupation of Position (RSOP)

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Existing, Modified or New DIS P	Required to Collect Data Elements	(X=Uneupportable by DIS PDUs)	This would require event report	PDUs of time of route-selection start	and stop.	•		Entity state PDU	•		Detonation PDU	P. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.		Entity state PDU	•	-	Determined through post-exercise	analysis							
Characteristics and Their Data Elements for Existing, Modified or New DIS PDUs	Collection if DIS Virtual Simulation is	Appropriate Environment	Time		automated route-selection speed	• Manual route-selection speed	<ul> <li>Automated site-selection speed</li> </ul>	◆ Manual site-selection speed		-							Accuracy		Were the computer-selected and manually	selected routes navigable according to the		Were the computer-selected and manually	selected sites acceptable according to the	completeness criteria?	
Measures of	Performance		Route Planning and	Site Selection Time,	Accuracy and	Completeness		Number of howitzer	moves		Number of rounds	delivered on target		Number of howitzers	surviving	ı									
Environments for	Testing/	Experimentation	Virtual or Live																						
Specifications			Survivability. The AFAS must optimize its	probability of survival via tactics and	appropriate susceptibility and vulnerability	reduction measures. The RSOP decision aid	contains route planning, navigation and firing	site selection capabilities that facilitate crew	performance evaluation in a simulation	environment with and without the decision-	aid capability. The RSOP decision aid contains	algorithms and rules that help crew members	by automatically considering threat line of	sight, communications line of sight and other	tactical considerations involving digital terrain	elevation data; and other factors that use	Digital Mapping Agency standard terrain	overlay information to automatically evaluate	routes and firing sites without the crew's	having to conduct reconnaissance or lengthy	paper map analyses.				

Subject of Experimentation/Testing: AFAS Decision Aid-Reconnaissance, Selection and Occupation of Position (RSOP)

Specifications	Environments for Testing/	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual	Existing, Modified or New DIS PDUs Required to Collect Data
	Experimentation		Simulation is Appropriate Environment	Elements (X=Unsupportable by DIS PDUs)
Survivability (continued)			Completeness	These could be determined by post-
			Did computer-selected and manually	bulleted items. Those items would
			selected routes consider the following	all be readily available in the existing
				NBC and Fuel Required. Fuel
			• NBC contamination	required could be reported with an
			• Entries and exits • Proximity to friendly units	event report PDO. NBC.
			•Communications line of sight with higher	by analyzing NBC threats
			headquarters and observers	(represented as environmental
			•Overhead clearance	
			Time to complete movement	
			• ruel required to complete movement • Slope	
			Surface conditions	
			• Threat • Military obstacles	
			Did computer-selected and manually selected sites consider the following	
			criteria?	
			NBC contamination	
			• Entries and exits	
			• Proximity to friendly units • Communications line of sight with higher	
			headquarters and observers	
			•Recent use of the firing position	
			<ul> <li>Countering)</li> <li>Coverage of howitzer area of responsibility</li> </ul>	
			•Slope	
			Surface conditions     Threat	
8	Virtual or Live	Time	Time	
by tracking individual speed and accuracy in executing the commands and other functions		Accuracy	Command execution speeds	×
associated with proper operation of the RSOP	-			
decision aid. Accuracy is a function of			Accuracy	
executing the commands in the proper sequence.			Correct operational sequencing	×

Subject of Experimentation/Testing: AFAS Decision Aid-Reconnaissance, Selection and Occupation of Position (RSOP)

Existing, Modified or New DIS PDUs Required to Collect Data Elements (X=Unsupportable by DIS PDUs)	This would require event report PDUs of time of route-selection start and stop.	Entity state PDU	Detonation PDU	Entity state PDU	Determined through post-exercise		
Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Time  Automated route-selection speed  Manual route-selection speed	• Automated site-selection speed • Manual site-selection speed			Accuracy	Were the computer-selected and manually selected routes navigable according to the completeness criteria?	Were the computer-selected and manually selected sites acceptable according to the completeness criteria?
Measures of Performance	Route Planning and Site Selection Time, Accuracy and Completeness	Number of howitzer moves	Number of rounds delivered on target	Number of howitzers surviving			
Environments for Testing/ Experimentation	Virtual or Live						
	Responsiveness. Though the AFAS is always available to shoot fire missions in support of the maneuver commander, i.e., while on the move or emplaced, the system's	The required response time while in position is only within 20 seconds: the response time	while moving is within 45 seconds. The more quickly the crew can execute its frequent survivability moves, the more quickly the	howitzer will be back in position for more rapid response. Since the RSOP decision aid reduces planning time and rapidly provides	the most acceptable routes and sites, it positively influences system responsiveness.		

Subject of Experimentation/Testing: AFAS Decision Aid-Reconnaissance, Selection and Occupation of Position (RSOP)

Specifications	Environments for Testing/	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual	Existing, Modified or New DIS PDUs Required to Collect Data
	Experimentation		Simulation is Appropriate Environment	Elements (X=Unsupportable by DIS PDUs)
Responsiveness (continued)			Completeness	These could be determined by post-
			Did computer-selected and manually	bulleted items. Those items would
	•		selected routes consider the following	all be readily available in the existing
			Criteria?	NBC and Buck Breeded of
			•NBC contamination	required could be renorted with an
			• Entries and exits	event report PDU. NBC
			• Proximity to friendly units	contamination could be determined
			•Communications line of sight with higher   by analyzing NBC threats	by analyzing NBC threats
			headquarters and observers	(represented as environmental
			Overhead concealment	entities).
			Overhead clearance	
			<ul> <li>Time to complete movement</li> </ul>	
			<ul> <li>Fuel required to complete movement</li> </ul>	
			• Slope	
			<ul> <li>Surface conditions</li> </ul>	
			• Threat	
			· Military obstacles	
			Did computer-selected and manufactured	
			selected sites consider the following	
			criteria?	
			• NBC contamination	
			• Entries and exits	
			· Proximity to friendly units	
			*Communications line of sight with higher	
			• Recent use of the firing position	
			(Counterfire)	
			•Coverage of howitzer area of responsibility	
	_		• Slope	
			• Surface conditions	
			• Th. eat	

Subject of Experimentation/Testing: AFAS Decision Aid-Reconnaissance, Selection and Occupation of Position (RSOP)

Virtual PDUs Required to Collect Data  Elements (X=Unsupportable by DIS PDUs)	This would require event report PDUs of time of route-selection start	and stop.	Entity state PDU	Detonation PDU	Entity state PDU	Determined through post-exercise	<u> </u>	anually the
Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Time	Automated route-selection speed     Manual route-selection speed     Automated site-selection speed	•Manual site-selection speed			Accuracy	Were the computer-selected and manually selected routes navigable according to the completeness criteria?	Were the computer-selected and manually selected sites acceptable according to the completeness criteria?
Measures of Performance	Route Planning and LRP-Selection Time,	Accuracy and Completeness	Number of howitzer moves	Number of rounds delivered on target	Number of howitzers surviving			
Environments for Testing/ Experimentation	Virtual and Live							
Specifications	Resupply. To enhance system effectiveness and responsiveness and increase the	survivability of both the FARV and the AFAS, the primary means of AFAS Class III (fuel) and Class V (orimary armament ammunition)	resupply will be automated and provided under armor by the FARV. Rapid, automated transfer operations will allow the AFAS to	receive ready-to-fire fuzed projectiles, eliminating manual ammunition processing and handling requirements under normal	AFAS operations. Other classes of supply may be manually supplied by the FARV or by other means. The AFAS will use embedded decision	aids to assist the crew in managing on-board inventories and resupply training.		

Subject of Experimentation/Testing: AFAS Decision Aid-Reconnaissance, Selection and Occupation of Position (RSOP)

- 2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment. Though decision aids are no longer considered a high-risk technology by military leaders, they still need to quantify the operational benefit of various decision-aid prototypes to justify the research and development expense associated with them. Both virtual and live simulations offer the opportunity for side-by-side comparison testing of crews with and without these devices. The integration of decision aids also permits early soldier/user input as to how decision-aid performance might be improved. Ultimately, crews can be trained to better use fielded decision aids.

  3. Required Resources. Decision-aid prototypes and interfaces, test and evaluation software to track decision-aid times and other variables, and, perhaps, video equipment to monitor crew performance.

Subject of Experimentation/Testing: AFAS Decision Aid-Self Defense

Specifications	Environments for Testing/ Experimentation	Messures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Etisting, Modified or New DIS PDUs Required to Collect Data Elements (X=Unsupportable by DIS PDUs)
Firepower. AFAS will provide responsive indirect fire to the maneuver forces. High speed automated firing data computation, advanced propulsion technology and automated ammunition handling, loading and firing will enable the AFAS to deliver massive and precise firepower as part of coordinated unit missions or independent single howitzer operations.		Number of Charge 2/3 self-defense rounds fired (killer junior), with and without DA	A 2 or 3 in the Charge field of a Mission Fired Report defines a self- defense round.	Signal PDU
Survivability. The system will optimize its probability of survival via tactics and appropriate susceptibility and vulnerability	Virtual or Live	Number of survivability moves, with and without DA (750 meters or less)	Possible Sensor Types  Radar	Entity state PDU
reduction measures. Decision aids will assist the crew in planning and conducting system survivability operations by providing		Number of AFASs that survive, with and without DA	<ul><li>Infrared</li><li>Acoustic</li><li>Magnetic</li></ul>	Entity state PDU
recommendations for responses to counteract identified threats. To survive, the AFAS must create a self-defense plan monitor and control		Number of enemy contact reports, with and without DA	Visual (Video camera) Signal PDU     Near Infrared     Onical Augmentation	Signal PDU
its own signatures and activities, and monitor threat activity, ultimately choosing to stay and fight the threat or run or hide from it		Number of Battle Damage Assessment Reports, with and without DA	• Electro-Magnetic (Radio)	Signal PDU
		Range of threat at sensor detection time, with and without DA	Kinds of FARV Signatures	Event report PDU
		Number of threat detections by sensor type, with and without DA	• Infrared • TMovement	Bvent report PDU
		Rounds fired in each position area, with and without DA	Radio Transmissions     Electromagnetic	Fire PDU or Signal PDU (MFR)
		Total number of rounds fired, with and without DA	• Visible Light • Incidental Signatures	Signal PDU (MFR)
		Number of Charge 2/3 self-defense rounds fired (killer junior)	Sources of threat information	
			On-board sensors     Intelligence reports     (displayed on FARV     digital map)	

Subject of Experimentation/Testing: AFAS Decision Aid-Self Defense

Characteristics and Existing Modified or New DIS Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Time  Command execution X  speeds  Accuracy  Correct operational X  sequencing
Measures of Performance Cha Their for Virt	Time Accuracy Commans speeds Accuracy Correct o
Environments for Testing/ Experimentation	Virtual or Live
Specifications	Training. Crew training level can be evaluated Virtual or I by tracking individual speed and accuracy in executing the commands and other functions associated with proper operation of the SD decision aid. Accuracy is a function of executing the commands in the proper sequence.

- 2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment. Though decision aids are no longer considered a high-risk technology by military leaders, they still nextle quantify the operational benefit of various decision-aid prototypes to justify the research and development expense associated with them. Both virtual and live simulations offer the opportunity for side-by-side comparison testing of crews with and without these devices. The integration of decision aids also permits early soldier/user input as to how decision-aid performance might be improved. Ultimately, crews can be trained to better use fielded decision aids.

  3. Required Resources. Decision-aid prototypes and interfaces, test and evaluation software to track decision-aid times and other variables, and, perhaps, video equipment to monitor crews performance.

Subject of Experimentation/Teeting: AFAS Decision Aid-Sustainment

Existing, Modified or New DIS PDUs Required to Collect Data Elements (X=Unsupportable by DIS PDUs)	Event report PDU		Signal PDU	Signal PDU	Signal PDU			
ents DIS on is	Classes of Supply: I Subsistence	II Clothing, individual equipment, tentage, tool sets, tool kits, hand tools, housekeeping	supplies and equipment III Petroleum fuels	IV Construction and barrier materials	V Ammunition VI Personal demand	items VII Major end items	VIII Medical materials	IX Repair parts and components
Measures of Performance	Total quantity of each class of supply delivered, with and without DA	total number of the missions returned as unsupportable to the Platoon Operations Center (POC) for each class of supply, with and without DA	Total number times the AFAS rendered non-operational because of the lack of a class of supply, with and without DA	Number of maintenance and resupply reports sent to the POC, LRP and FARV, with and without DA	Total number of missions fired, with and without DA			
Environments for Testing/ Experimentation	Virtual or Live							
Specifications	Resupply. The AFAS Sustainment decision aid (DA) will provide performance support in the areas of maintenance management,	inventory control, records management, requisitioning and the creation and maintenance of crew rotation schedules. Applicable functions apply to all classes of supply.						

Subject of Experimentation/Testing: AFAS Decision Aid-Sustainment

Specifications	Environments for	Measures of Performance	Characteristics and	Printing Madified or New DIS
	Testing/		Their Data Elements	PDUs Required to Collect Data
	Experimentation		for Collection if DIS	Elements (X=Unsupportable by
			Appropriate Environment	
Command, Control and Communications (C3).	Virtual or Live	For each mode of operation:	Classes of Supply:	
The system shall be capable or centralized and decentralized modes of operation to provide a broad spectrum of communications.		Total quantity of each class of supply delivered, with and without DA	I Subsistence	Event report PDU
capabilities.		Number of maintenance and resupply	II Clothing, individual equipment, tentage,	Signal PDU
		reports sent to the P.C., LRP and FARV, with and without DA	tool sets, tool kits, hand tools, housekeeping supplies and equipment	
			III Petroleum fuels	
			IV Construction and barrier materials	
			V Ammunition	
			VI Personal demand items	
			VII Major end items	
			VIII Medical materials	
			IX Repair parts and components	
Training. Crew training level can be evaluated	Virtual or Live	Time	Time	
executing the commands and other functions associated with proper operation of the FMP		Accuracy	Command execution speeds	×
executing the commands in the proper			Accuracy	
			Correct operational sequencing	×

Subject of Experimentation/Testing: AFAS Decision Aid-Sustainment

Existing, Modified or New DIS PDUs Required to Collect Data Elements (X=Unsupportable by DIS PDUs)	Signal PDU and Fire PDU	Event report PDU						Signal PDU				
Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Classes of Supply:	I Subsistence	equipment, tentage,	tools, housekeeping	supplies and equipment	III Petroleum fuels	IV Construction and barrier materials	V Ammunition	VI Personal demand items	VII Major end items	VIII Medical materials	IX Repair parts and components
Measures of Performance	AFAS fire mission response time, with and Classes of Supply: without DA	Total quantity of each class of supply	Total number of AEAS fire missions	returned as unsupportable to the Platoon	Operations Center (POC) for each class of supply, with and without DA	Total number times the AFAS rendered	class of supply, with and without DA	Number of maintenance and resupply reports sent to the POC, LRP and FARV, with and without DA				
Environments for Testing/ Experimentation	Virtual or Live											
Specifications	Responsivences. Though the AFAS is always available to shoot fire missions in support of	move or emplaced, the AFAS's responsiveness	resupply itself. The required AFAS in a management of the required properties of the required properties in a continuity of the required properties of the results of the r	within 20 seconds; the response time while	moving is within 45 seconds.							

- 2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment. Though decision aids are no longer considered a high-risk technology by military leaders, they still need to quantify the operational benefit of various decision-aid prototypes to justify the research and development expense associated with them. Both virtual and live simulations offer the opportunity for side-by-side comparison testing of crews with and without these devices. The integration of decision aids also permits early soldier/user input as to how decision aid.

  3. Required Resources. Decision-aid prototypes and interfaces, test and evaluation software to track decision-aid times and other variables, and, perhaps, video equipment to monitor crowled performance.

# Subject of Experimentation/Testing: AFAS Decision Aid-Embedded Training (ET) and ET During System Operations

Note: ET must be used in conjunction with the other components of the integrated decision enhancement system (DES). ET will not operate by itself to support crew manual operations. In addition, only the performance support component of ET can be evaluated in a virtual or live environment; therefore, the variables "ET during system operations" and "ET decision aid" are synonymous.

Specifications		Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Edsting, Modified or New DIS PDUs Required to Collect Data Elements (X=Unsupportable by DIS PDUs)
Firepower. The AFAS will provide responsive indirect fire to the maneuver forces. High speed automated firing data computation.	Virtual or Live	Total number of rounds fired, with and without DA		Hire PDU or Signal PDU (MPRs)
advanced propulsion technology, and automated ammunition handling, loading and firing will enable the AFAS to deliver massive and provise frequence as Pract of constitutional		Total number of fire missions returned as unsupportable to the Platoon Operations Center (POC), with and without DA		Signal PDU
unit missions or independent single howitzer unit missions. The ET decision aid (DA) will provide over-the-shoulder coaching and just-in-time help, the performance support component of the ET requirement, which		Number of fire missions returned as unsupportable to the POC for insufficient appropriate ammunition, with and without DA		Signal PDU
_		Time fired and sequence of missions fired with fire order components listed, with and without DA		Fire PDU and Event report PDU
Command, Control and Communications (C3). The system shall be capable of centralized, decentralized and senior/subordinate modes of	Virtual or Live	For each mode of operation: Total number of rounds fired, with and		Fire PDU or Signal PDU (MFRs)
operation.		without DA  Total number of fire missions returned as unsupportable to the Platoon Operations Center (POC), with and without DA		Signal PDU
		Number of fire missions returned as unsupportable to the POC for insufficient appropriate ammunition, with and without DA		Signal PDU
		Time fired and sequence of missions fired with fire order components listed, with and without DA		Fire PDU and Event report PDU
		Total time required to execute each fire mission while in position, with and without DA		Event report PDU
		Total time required to execute each fire mission while moving, with and without DA		Event report PDU

Subject of Experimentation/Testing: AFAS Decision Aid-Embedded Training (ET) and ET During System Operations

Specifications	<b>Environments for</b>	Measures of Performance	Characteristics and	Existing, Modified or New DIS
,	Testing/		Their Data Elements	PDUs Required to Collect Data
	Experimentation		for Collection if DIS Virtual Simulation is	Elements (X=Unsupportable by DIS PDUs)
			Appropriate Environment	
Training. Crew training level can be evaluated by tracking individual eneed and accuracy in	Virtual or Live	Time	Time	
executing the commands and other functions associated with proper operation of the FMP			Command execution speeds	×
decision aid. Accuracy is a function of executing the commands in the proper			Accuracy	
sequence.	_		Correct operational sequencing	×
	Virtual or Live	Route Planning and Site Selection Time,	Time	This would require event report
Selection. The AFAS must optimize its probability of survival via factics and		Accuracy and Completeness	• Automated route.	PDUs of time of route-selection start and along
appropriate susceptibility and vulnerability			selection speed	
reduction measures. The KNO'r decision and contains route planning, navigation and firing		Number of nowitzer moves	• Manual route- selection speed	Entity state PDU
site selection capabilities that facilitate crew		Number of rounds delivered on target	• Automated site-	
principles of the service of the ser		Number of howitzers surviving	• Manual site-selection speed	Detonation PDU
algorithms and rules that help crew members		0		
by automatically considering threat line of sight, communications line of sight and other factical considerations involving digital ferrain				Entity state PDU
elevation data; and other factors that use			Accuracy	Determined through post-exercise
overlay information to automatically evaluate coutes and firing sites without the crew's having to conduct reconnaissance or lengthy paper map analyses.			Were the computer- selected and manually selected routes navigable according to the completeness	
			Were the computer- selected and manually selected sites acceptable according to the completeness criteria?	

Subject of Experimentation/Testing: AFAS Decision Aid-Embedded Training (ET) and ET During System Operations

Specifications	Environments for	Measures of Performance	Characteristics and	Existing, Modified or New DIS
	Testing/		Their Data Elements	PDUs Required to Collect Data
	Experimentation		for Collection if DIS	Elements (X=Unsupportable by
	1		Virtual Simulation is	DIS PDUs)
			Appropriate	
			Environment	
Survivability (continued)			Completeness	These could be determined by post-
			•	exercise analysis of each of the
			Did computer-selected	bulleted items. Those items would
			and manually selected	all be readily available in the existing
			routes consider the	DIS versions with the exception of
			following criteria?	NBC and Fuel Required. Fuel
			·	required could be reported with an
			NBC contamination	event report PDU. NBC
			• Entries and exits	contamination could be determined
			<ul> <li>Proximity to friendly</li> </ul>	by analyzing NBC threats
			units	(represented as environmental
			•Communications line	
			of sight with higher	•
			headquarters and	
			observers	
			•Overhead	
			concealment	
			Overhead clearance	
			•Time to complete	
			movement	
			• Puel required to	
			complete movement	
			•Slope	
			<ul> <li>Surface conditions</li> </ul>	
			-Threat	
			• Military obstacles	

Subject of Experimentation/Testing: AFAS Decision Aid-Embedded Training (ET) and ET During System Operations

Existing, Modified or New DIS PDUs Required to Collect Data Elements (X=Unsupportable by DIS PDUs)						
Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Completeness (continued)	Did computer-selected and manually selected sites consider the following criteria?	• NBC contamination • Entries and exits • Proximity to friendly units	of sight with higher headquarters and observers.	firing position (Counterfire) •Coverage of howitzer	<ul> <li>Slope</li> <li>Surface conditions</li> <li>Threat</li> </ul>
Measures of Performance						
Environments for Testing/ Experimentation						
Specifications	Survivability (continued)					

Subject of Experimentation/Testing: AFAS Decision Aid-Embedded Training (ET) and ET During System Operations

Specifications	<b>Environments for</b>	Measures of Performance	Characteristics and	Existing, Modified or New DIS
•	Testing/		Their Data Elements	PDUs Required to Collect Data
	Experimentation		for Collection if DIS Virtual Simulation is	Elements (X=Unsupportable by DIS PDUs)
			Appropriate Environment	
Survivability in Self Defense. The system will	Virtual or Live	Number of survivability moves, with and	Possible Sensor Types	Entity state PDU
optimize its probability of survival via tactics		without DA		
			• Radar	
vulnerability reduction measures. Decision		Number of AFASs that survive, with and	• Infrared	Entity state PDU
aids will assist the crew in planning and		without DA	• Acoustic	
conducting system survivability operations by		Number of enemy contact reports with and		Signal PDI1
counteract identified threats. To survive, the				
AFAS must create a self-defense plan, monitor			Optical Augmentation	
and control its own signatures and activities,		Number of Battle Damage Assessment	Electro-Magnetic	Signal PDU
and monitor threat activity, ultimately		Reports, with and without DA	(Radio)	
choosing to stay and fight the threat, or run or				
hide from it.		Range of threat at sensor detection time,	Kinds of FARV	Event report PDU
		with and without DA	Signatures	
		Number of threat detection's by sensor type	• Infrared	Event report PDI
		with and without DA	•¶Movement	
		Rounds fired in each position area, with	sions	Fire PDU or Signal PDU (MFR)
		and without DA	Electromagnetic     Radiation	
		Total number of rounds fired, with and	<ul> <li>Visible Light</li> </ul>	Signal PDU (MFR)
		without DA	<ul> <li>Incidental Signatures</li> </ul>	
		Number of Charge 2/3 self-defense rounds	Sources of threat	
		fired (killer junior)	information	
			•On-board sensors	
			•Intelligence reports (displayed on FARV	
			digital map)	

Subject of Experimentation/Testing: AFAS Decision Aid-Embedded Training (ET) and ET During System Operations

Total number of rounds fired, with and without DA  Total number of fire missions returned as unsupportable to the Platoon Operations Center (POC), with and without DA
Number of fire missions returned as unsupportable to the POC for insufficient appropriate ammunition, with and without DA
Time fired and sequence of missions fired with fire order components listed, with and without DA
Total time required to execute each fire mission while in position, with and without DA
Total time required to execute each fire mission while moving, with and without DA

Subject of Experimentation/Testing: AFAS Decision Aid-Embedded Training (ET) and ET During System Operations

Subject of Experimentation/Testing: AFAS Decision Aid-Embedded Training (ET) and ET During System Operations

Existing, Modified or New DIS PDUs Required to Collect Data Elements (X=Unsupportable by DIS PDUs)																					
Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Completeness	Did computer-selected	and manually selected routes consider the	following criteria?	NBC contamination	• Entries and exits	*Proximity to friendly	units	• Communications line	headquarters and	observers	Overhead	concearment	•Time to complete	movement	• Fuel required to	complete movement	• Slope	•Surface conditions	-Threat	<ul> <li>Military obstacles</li> </ul>
Measures of Performance																					
Environments for Testing/ Experimentation																					
Specifications	Responsiveness (continued)																				

Subject of Experimentation/Testing: AFAS Decision Aid-Embedded Training (ET) and ET During System Operations

Existing, Modified or New DIS PDUs Required to Collect Data Elements (X=Unsupportable by DIS PDUs)						
Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Completeness (continued)	Did computer-selected and manually selected sites consider the following criteria?	NBC contamination     Entries and exits     Proximity to friendly units	•Communications line of sight with higher headquarters and observers	<ul> <li>Kecent use of the firing position (Counterfire)</li> <li>Coverage of howitzer</li> </ul>	area of responsibility • Slope • Surface conditions • Threat
Measures of Performance						
Environments for Testing/ Experimentation						
Specifications	Responsiveness (continued)					

Subject of Experimentation/Testing: AFAS Decision Aid-Embedded Training (ET) and ET During System Operations

·			
Existing, Modified or New DIS PDUs Required to Collect Data Elements (X=Unsupportable by DIS PDUs)	Signal PDU and Fire PDU  Event report PDU  Signal PDU	Signal PDU Signal PDU	
Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Classes of Supply: Signal PDU I Subsistence II Clothing, individual equipment, tentage, tool sets, tool kits, hand tools, housekeeping supplies and equipment	III Petroleum fuels IV Construction and barrier materials V Ammunition	VI Personal demand items VII Major end items VIII Medical materials IX Repair parts and components
Measures of Performance	without DA  Total quantity of each class of supply delivered, with and without DA  Total number of AFAS fire missions returned as unsupportable to the Platoon Operations Center (POC) for each class of supplies and supply, with and without DA	Total number times the AFAS rendered non-operational because of the lack of a class of supply, with and without DA Number of maintenance and resupply reports sent to the POC, LRP and FARV, with and without DA	
Environments for Testing/ Experimentation	Virtual or Live		
Specifications	Responsiveness in Sustainment Operations. Though the AFAS is always available to shoot fire missions in support of the maneuver commander, i.e., while on the move or emplaced, the AFAS's responsiveness is affected by its ability to maintain and resupply itself. The required AFAS fire mission response time while in position is within 20 seconds; the response time while moving is within 45 seconds.		

Subject of Experimentation/Testing: AFAS Decision Aid-Embedded Training (ET) and ET During System Operations

nd Existing, Modified or New DIS nts PDUs Required to Collect Data DIS Elements (X=Unsupportable by n is	This would require event report PDUs of time of route-selection start and stop.  Entity state PDU Detonation PDU Determined through post-exercise analysis to
Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Time  • Automated route- selection speed • Automated site- selection speed • Automated site- selection speed • Manual site-selection speed  • Manual site-selection speed  • Manual site-selection speed  • Manual site-selection speed  • Manual site-selection speed  • Ware the computer- selected and manually selected sites acceptable according to the completeness criteria?
Measures of Performance	Route Planning and LRP-Selection Time, Accuracy and Completeness  Number of howitzer moves  Number of howitzers  surviving
Environments for Testing/ Experimentation	Virtual and Live
Specifications	Resupply (Route Planning and Site Selection).  To enhance system effectiveness and responsiveness and increase the survivability of both the FARV and the AFAS, the primary means of AFAS Class III (fuel) and Class V (primary armament ammunition) resupply will be automated and provided under armor by the FARV. Rapid, automated transfer operations will allow the AFAS to receive ready-to-fire fuzed projectiles, eliminating manual ammunition processing and handling requirements under normal AFAS operations. Other classes of supply may be manually supplied by the FARV or by other means. The AFAS will use embedded decision aids to assist the crew in managing on-board inventories and resupply training.

Subject of Experimentation/Testing: AFAS Decision Aid-Embedded Training (ET) and ET During System Operations

Specifications	Environments for	Messures of Performance	Characteristics and	Printing Madified or New Die
	Testing/		Their Data Elements	PDUs Required to Collect Data
	Experimentation		for Collection if DIS	Elements (X=Unsupportable by
			Virtual Simulation is	DIS PDUs)
			Appropriate	
Resupply (continued)			Completeness	
			i	
			Did computer-selected	
			and manually selected	
			following criteria?	
			NBC contamination	
			• Entries and exits	
			• Proximity to friendly	
			units	
			•Communications line	
			of sight with higher	
			headquarters and	
			observers	
			•Overhead	
			concealment	
			Overhead clearance	
			• Time to complete	
			movement	
			<ul> <li>Fuel required to</li> </ul>	
			complete movement	
			•Slope	
			<ul> <li>Surface conditions</li> </ul>	
			-Threat	
			<ul> <li>Military obstacles</li> </ul>	

Subject of Experimentation/Testing: AFAS Decision Aid-Embedded Training (ET) and ET During System Operations

Specifications	Environments for	Measures of Performance	Characteristics and	Existing, Modified or New DIS
	Experimentation		for Collection if DIS Virtual Simulation is Appropriate Environment	Elements (X=Unsupportable by DIS PDUs)
			Completeness (continued)	
			Did computer-selected and manually selected sites consider the	
			following criteria?	
			• NBC contamination	
			• Proximity to friendly	
			units •Communications line	
			of sight with higher	
			headquarters and observers	
			• Recent use of the	
			firing position	
			(Counterfire)	
			Coverage of nowicer	
			Slope	
			•Surface conditions	
			• Threat	

Subject of Experimentation/Testing: AFAS Decision Aid-Embedded Training (ET) and ET During System Operations

	Environments for Testing/	Measures of Performance	Characteristics and Their Data Elements	Existing, Modified or New DIS PDUs Required to Collect Data
	Experimentation		for Collection if DIS Virtual Simulation is Appropriate Environment	Elements (X=Unsupportable by DIS PDUs)
Resupply (Sustainment). The AFAS Sustainment decision aid (DA) will provide	Virtual or Live	Total quantity of each class of supply delivered, with and without DA	Classes of Supply:	Event report PDU
performance support in the areas of maintenance management, inventory control.		Total number of fire missions returned as	I Subsistence	Signal PDU
records management, requisitioning and the creation and maintenance of crew rotation schedules. Applicable functions apply to all		unsupportable to the Platoon Operations Center (POC) for each class of supply, with and without DA	II Clothing, individual equipment, tentage, tool sets, tool kits, hand	
classes of supply.		Total number times the AFAS rendered non-operational because of the lack of a	tools, housekeeping supplies and equipment	Signal PDU
		class of supply, with and without DA	III Petroleum fuels	
		reports sent to the POC, LRP and FARV, with and without DA	IV Construction and barrier materials	olgnar FDC
		Total number of missions fired, with and	V Ammunition	Signal PDU
		Alitous Alitou	VI Personal demand items	
			VII Major end items	
			VIII Medical materials	
			IX Repair parts and components	

- 2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment. Though decision aids are no longer considered a high-risk technology by military leaders, they still need to quantify the operational benefit of various decision-aid prototypes to justify the research and development expense associated with them. Both virtual and live simulations offer the opportunity for side-by-side comparison testing of crews with and without these devices. The integration of decision aids also permits early soldier/user input as to how decision-aid performance might be improved. Ultimately, crews can be trained to better use fielded decision aids.

  3. Required Resources. Decision-aid prototypes and interfaces, test and evaluation software to track decision-aid times and other variables, and, perhaps, video equipment to monitor crew performance.

Subject of Experimentation/Testing: FARV Decision Aid-Mission Management

Note: FARV Mission Management includes the sustainment functions listed separately for the AFAS.

Their Data Elements  for Collection if DIS  Virtual Simulation is Appropriate  Total number of AFAS fire missions returned as unsupportable to the Platoon Operations Center (PCC) for each class of supply, with and without MM DA Total number times the FARV rendered non-operational because of the lack of a class of supply, with and without MM DA  Number of maintenance and resupply reports sent to the POC and LRP, with and without MM DA  Number of maintenance and resupply reports sent to the POC and LRP, with and without MM DA  Number of maintenance and resupply reports sent to the POC and LRP, with and without MM DA  V Ammunition VII Personal demand items VIII Medical materials  IX Repair parts and components	Specifications	Environments for	Measures of Performance	Characteristics and	Existing, Modified or New DIS PDUs
Virtual Simulation is Appropriate Environment  Virtual or Live Total quantity of each class of supply  delivered, with and without MM DA  Total number of AFAS fire missions returned as unsupportable to the Platoon Operations Center (PCC) for each class of supply, with and without MM DA  Total number times the FARV rendered non-operational because of the lack of a equipment tension sof supply, with and without MM DA  Number of maintenance and resupply reports sent to the PCC and LRP, with and without MM DA  VI Personal demand litems  VII Major end items  VIII Medical materials  VIII Medical materials  VOUND MADOR PARS OF SUPPLY P	•	Testing/		Their Data Elements	Required to Collect Data Elements
Virtual or Live Total quantity of each class of supply delivered, with and without MM DA  Total number of AFAS fire missions returned as unsupportable to the Platoon Operations Center (POC) for each class of supply, with and without MM DA Total number times the FARV rendered non-operational because of the lack of a class of supply, with and without MM DA III Petroleum fuels Number of maintenance and resupply reports sent to the POC and LRP, with and without MM DA  VI Personal demand items VII Medical materials Components				Virtual Simulation is Appropriate Environment	
Total number of AFAS fire missions returned as unsupportable to the Platoon Operations Center (POC) for each class of supply, with and without MM DA tool sets, tool kits, hand non-operational because of the lack of a class of supply, with and without MM DA tool sets, tool kits, hand non-operational because of the lack of a class of supply, with and without MM DA tool sets, tool kits, hand non-operational because of the lack of a class of supply, with and without MM DA tool sets, tool kits, hand non-operational because of the PARV rendered supplies and non-operational demand supplies and non-operationa	Resupply. The FARV will provide AFAS with		Total quantity of each class of supply	Classes of Supply:	Event report PDU
Total number of AFAS fire missions returned as unsupportable to the Platoon Operations Center (POC) for each class of supply, with and without MM DA tools, housekeeping supplies and non-operational because of the lack of a class of supply, with and without MM DA without MM DA III Petroleum fuels because to the POC and LRP, with and without MM DA without MM DA WITHOUT MA DA WITHOUT MM DA WITHOUT MAIOR MAIO	Class V (primary armament ammunition).	-	delivered, with and without that DA	I Subsistence	
returned as unsupportable to the Platoon  Operations Center (POC) for each class of supply, with and without MM DA  Total number times the FARV rendered non-operational because of the lack of a class of supply, with and without MM DA  Number of maintenance and resupply reports sent to the POC and LRP, with and without MM DA  W Ammunition  VI Personal demand items  VIII Medical materials  IX Repair parts and components	Rapid, automated transfer operations will		Total number of AFAS fire missions		Signal PDU
Supply, with and without MM DA  supply, with and without MM DA  Total number times the FARV rendered non-operational because of the lack of a class of supply, with and without MM DA  Number of maintenance and resupply reports sent to the POC and LRP, with and without MM DA  VI Personal demand items  VIII Medical materials  VIII Medical materials  COMPONDED  VIII Medical materials  COMPONDED	allow the system to rearm AFAS with ready-to-		returned as unsupportable to the Platoon	II Clothing, individual	<b>.</b>
supply, with and without MM DA  Total number times the FARV rendered non-operational because of the lack of a class of supply, with and without MM DA  Number of maintenance and resupply reports sent to the POC and LRP, with and without MM DA  V Ammunition  VI Personal demand items  VIII Medical materials  IX Repair parts and components	fire fuzed projectiles, LP and fuel, eliminating		Operations Center (POC) for each class of	equipment, tentage,	
Total number times the FARV rendered supplies and non-operational because of the lack of a class of supply, with and without MM DA  Number of maintenance and resupply reports sent to the POC and LRP, with and without MM DA  V Ammunition  VI Personal demand items  VIII Medical materials  VIII Medical materials  Components	manual ammunition processing and handling		supply, with and without MM DA	tool sets, tool kits, hand	
non-operational because of the lack of a equipment class of supply, with and without MM DA III Petroleum fuels reports sent to the POC and LRP, with and barrier materials without MM DA VI Personal demand items  VIII Major end items  VIII Medical materials VIII Medical materials components	organical direct holing rowy of the propertions Other classes of supply may be		Total number times the EARV rendered	control in the sand	
Class of supply, with and without MM DA  III Petroleum fuels  Number of maintenance and resupply reports sent to the POC and LRP, with and barrier materials without MM DA  V Ammunition VI Personal demand items VIII Medical materials  IX Repair parts and components	manually supplied to AFAS. The system will		non-operational because of the lack of a	equipment	Signal PDU
Number of maintenance and resupply reports sent to the POC and LRP, with and barrier materials without MM DA  V Ammunition  VI Personal demand items  VIII Medical materials VIII Repair parts and components	use embedded decision aids to assist the crew		class of supply, with and without MM DA		)
Number of maintenance and resupply reports sent to the POC and LRP, with and barrier materials without MM DA  V Ammunition  VI Personal demand items  VII Major end items  VIII Medical materials IX Repair parts and components	in managing on-board inventories and			III Petroleum fuels	
reports sent to the POC and LRP, with and barrier materials without MM DA barrier materials V Ammunition VI Personal demand items VII Major end items VIII Medical materials IX Repair parts and components	resupply planning.		Number of maintenance and resupply		
V Ammunition VI Personal demand items VII Major end items VIII Medical materials IX Repair parts and components			reports sent to the POC and LRP, with and	IV Construction and	
V Ammunition VI Personal demand items VII Major end items VIII Medical materials IX Repair parts and components			without MM DA	barrier materials	Signal PDU
VI Personal demand items VII Major end items VIII Medical materials IX Repair parts and components				V Ammunition	
VII Major end items VIII Medical materials IX Repair parts and				VI Personal demand	
VII Major end items VIII Medical materials IX Repair parts and				items	
VIII Medical materials IX Repair parts and				VII Major end items	
IX Repair parts and components				VIII Medical materials	
				IX Repair parts and components	

Subject of Experimentation/Testing: FARV Decision Aid-Mission Management

Charifications	Engironmente for	Massives of Partnemance	Characteristics and	Puletten Madified or Nam Die
	Testino/		Their Data Elements	PDI is Required to Collect Data
	Experimentation		for Collection if DIS	Elements (X=Unsupportable by
	•		Virtual Simulation is	DIS PDÚs)
			Appropriate Environment	
Command, Control and Communications (C3).	Virtual or Live	For each mode of operation:	Classes of Supply:	
decentralized modes of operation to provide a decentralized modes of operation to provide a		Total quantity of each class of supply delivered with and without MM DA	I Subsistence	Event report PDU
capabilities.			II Clothing, individual	
		Number of maintenance and resupply reports sent to the POC and LRP, with and	equipment, tentage, tool sets, tool kits, hand	Signal PDU
	•	without MM DA	tools, housekeeping supplies and equipment	
			III Petroleum fuels	
			IV Construction and barrier materials	
			V Ammunition	
			VI Personal demand items	
			VII Major end items	
	-		VIII Medical materials	
			IX Repair parts and components	
pa	Virtual or Live	Time	'fime	
executing the commands and other functions associated with proper operation of designs and other functions.		Occuracy .	Command execution speeds	×
executing the commands in the proper			Accuracy	
			Correct operational sequencing	×

Subject of Experime. Tation/Testing: FARV Decision Aid-Mission Management

Testing/ Experimentation			3
erimentation		Their Data Elements	PDUs Required to Collect Data
ì	Ę	for Collection if DIS Virtual Simulation is	Elements (X=Unsupportable by DIS PDUs)
		Appropriate Environment	
Virtual or Live	AFAS fire mission response time, with and	Classes of Supply:	Signal PDU and Fire PDU
		Subsistence	
	Total quantity of each class of supply		Event report PDU
	delivered, with and without MM DA	II Clothing, individual	
		equipment, tentage,	
	Total number of AFAS fire missions	tool sets, tool kits, hand Signal PDU	Signal PDU
	returned as unsupportable to the Platoon	tools, housekeeping	
	Operations Center (POC) for each class of	supplies and	
	supply, with and without MM DA	equipment	
	Total number times the FARV rendered	III Petroleum fuels	
	non-operational because of the lack of a		Signal PDU
	class of supply, with and without MM DA	IV Construction and	
	Number of maintenance and resupply		
	reports sent to the POC and LRP, with and without MM DA	V Ammunition	Gons PDH
		VI Personal demand items	
		VII Major end items	
		VIII Medical materials	
		IX Repair parts and components	

2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment. Though decision aids are no longer considered a high-risk technology by military leaders, they still need to quantify the operational benefit of various decision-aid prototypes to justify the research and development expense associated with them. Both virtual and live simulations offer the opportunity for side-by-side comparison testing of crews with and without these devices. The integration of decision aids also permits early soldier/user input as to how decision-aid performance might be improved. Ultimately, crews can be trained to better use fielded decision aids.

3. Required Resources. Decision-aid prototypes and interfaces, test and evaluation software to track decision-aid times and other variables, and, perhaps, video equipment to monitor crew performance.

Subject of Experimentation/Testing: FARV Decision Aid-Reconnaissance, Selection and Occupation of Position (RSOP)

Characteristics and Their Data Elements for Existing, Modified or New DIS PDUs Collection if DIS Virtual Simulation is Required to Collect Data Elements Appropriate Environment (XwUnsupportable by DIS PDUs)	A S			Entity state PDO		Resupply received PDU	•		Entity state PDU			Determined through post-exercise	analysis	d manually	ing to the		:	d manually	an or Su
Characteristics and Their Data Elements f Collection if DIS Virtual Simulation is Appropriate Environment	Time	Automated route-selection speed     Manual route-selection speed	• Automated LRP-selection speed	• Manual LKF-selection speed								Accuracy		Were the computer-selected and manually	selected routes navigable according to the	completeness criteria?		Were the computer-selected and manually	seierien Turis arreptable according to the
Measures of Performance	Route Planning and LRP-Selection Time,	Accuracy and	Comprehensia	Number of FAKV		Number of rounds	delivered		Number of FARVs	surviving	ı								
Environments for Testing/	Virtual or Live																		
Specifications	Survivability. The FARV must optimize its probability of survival via tactics and	appropriate susceptibility and vulnerability reduction measures. The RSOP decision aid	contains route planning, navigation and LRP	performance evaluation in a simulation	environment with and without the decision-	aid capability. The RSOP decision aid contains	algorithms and rules that help crew members	by automatically considering threat line of	sight, communications line of sight and other	tactical considerations involving digital terrain	elevation data; and other factors that use	Digital Mapping Agency standard terrain	overlay information to automatically evaluate	routes and LRPs without the crew's having to	conduct reconnaissance or lengthy paper map	analyses.			

Subject of Experimentation/Testing: FARV Decision Aid-Reconnaissance, Selection and Occupation of Position (RSOP)

Specifications	Environments for		Characteristics and Their Data	Existing Modified or New DIS
	I esting/ Experimentation	Pertormance	Elements for Collection if DIS Virtual Simulation is Appropriate	FDUS Required to Collect Data Elements (X=Unsupportable by
Survivability (continued)			Completeness	These could be determined by post-
			Did computer-selected and manually	exercise analysis of each of the bulleted items. Those items would
			selected routes consider the following criteria?	all be readily available in the existing DIS versions with the excention of
				NBC and Fuel Required. Fuel
			NBC contamination     Description to friendly notice	required could be reported with an
			Communications line of sight with higher	
			headquarters and AFASs	by analyzing NBC threats
			•Overhead clearance	entities).
			• Time to complete movement • First required to complete movement	
			•Slope	
			•Surface conditions	
			• Inreat • Military obstacles	
			Did computer-selected and manually selected LRPs consider the following	
			criteria?	
			NBC contamination	
			• Entries and exits	
			Proximity to friendly units	
			•Communications line of sight with higher	
			headquarters and AFASs • Recent use of the LRP (Counterfire)	
			•Slope •Surface conditions	
			• Threat	
Training. Crew training level can be evaluated	Virtual or Live	Time	Time	
executing the commands and other functions		Accuracy	Command execution speeds	×
associated with proper operation of the RSOP decision aid. Accuracy is a function of			Accuracy	
executing the commands in the proper		_	Correct onerational sequencing	*
l sequence.			dimension minimade transce	

Subject of Experimentation/Testing: FARV Decision Aid-Reconnaissance, Selection and Occupation of Position (RSOP)

Simulation is Appropriate  Simulation is Appropriate  Route Planning and Time Site Selection Time Site Selection Time Site Selection Time Site Selection Time  Accuracy and Accuracy  Number of FARV  Number of rounds  delivered  Number of FARVs  surviving  Accuracy  Were the computer-selected and manually selected routes navigable according to the completeness criteria?  Where the computer-selected and manually selected LRPs acceptable according to the completeness criteria?	Specifications   E	Environments for	Measures of	Characteristics and Their Data	Existing, Modified or New DIS
Route Planning and Site Selection Time.  Accuracy and • Automated route-selection speed • Manual route-selection speed • Automated LRP-selection speed • Manual LRP-selection speed moves  Number of FARV • Manual LRP-selection speed • Manual LRP-selection speed works  Number of FARV • Manual LRP-selection speed • Manually selected routes navigable according to the completeness criteria?		Lesting/ Experimentation	renormance	Elements for Collection if DIS Virtual Simulation is Appropriate Environment	FDUS Required to Collect Data Elements (X=Unsupportable by DIS PDUs)
Acutanal route-selection speed Automated LRP-selection speed  Manual LRP-selection speed  Manual LRP-selection speed  Mere the computer-selected and manually selected routes navigable according to the completeness criteria?  Were the computer-selected and manually selected LRPs acceptable according to the completeness criteria?	2_	Virtual or Live			This would require event report PDUs of time of route-selection start
f FARV f rounds f rounds f FARVs  Accuracy Were the computer-selected and manually selected routes navigable according to the completeness criteria? Were the computer-selected and manually selected LRPs acceptable according to the completeness criteria?			Accuracy and Completeness	Automated route-selection speed     Manual route-selection speed     Automated LRP-selection speed	and stop.
FARVs  Accuracy  Were the computer-selected and manually selected routes navigable according to the completeness criteria?  Were the computer-selected and manually selected LRPs acceptable according to the completeness criteria?		-	Number of FARV moves	•Manual LRP-selection speed	Entity state PDU
Accuracy  Were the computer-selected and manually selected routes navigable according to the completeness criteria?  Were the computer-selected and manually selected LRPs acceptable according to the completeness criteria?			Number of rounds delivered		Resupply received PDU
<u> </u>			Number of FARVs surviving		Entity state PDU
<u> </u>				Accuracy	Determined through post-exercise
Were the computer-selected and manually selected LRPs acceptable according to the completeness criteria?				Were the computer-selected and manually selected routes navigable according to the completeness criteria?	
				Were the computer-selected and manually selected LRPs acceptable according to the completeness criteria?	

Subject of Experimentation/Testing: FARV Decision Aid-Reconnaissance, Selection and Occupation of Position (RSOP)

Specifications	Environments for	Measures of	Characteristics and Their Data	Existing, Modified or New DIS
	Testing/	Performance	Elements for Collection if DIS Virtual	PDUs Required to Collect Data
	Experimentation		Simulation is Appropriate Environment	Elements (X=Unsupportable by DIS PDUs)
Responsiveness (continued)			Completeness	These could be determined by post-
			Did committee selected and manually	exercise analysis of each of the hillstod from Those items
			selected routes consider the following	all be readily available in the existing
			criteria?	DIS versions with the exception of
				NBC and Fuel Required. Fuel
			NBC contamination	required could be reported with an
			Proximity to friendly units	
			•Communications line of sight with higher	
			headquarters and ArASS	by analyzing NBC threats
			• Overnead concealment	(represented as environmental
			•Overhead clearance	entities).
			•Time to complete movement	
			• Fuel required to complete movement	
			•Slope	
			•Surface conditions	
			- Threat	
			•Military obstacles	
			Did computer-selected and manually selected LRPs consider the following	
			criteria?	
			NBC contamination	
			• Entries and exits	
			Dimensions of clearings	
		_	• Proximity to irrendily units	
			*Communications line of signt with higher	
			• Recent use of the LRP (Counterfire)	
			•Slope	
			Surface conditions	
:			• Threat	

Subject of Experimentation/Testing: FARV Decision Aid-Reconnaissance, Selection and Occupation of Position (RSOP)

Specifications	Environments for	Measures of	Characteristics and Their Data	Bristing Madified or New DIG
•	Testing/	Performance	Elements for Collection if DIS Virtual	PDUs Required to Collect Data
	Experimentation		Simulation is Appropriate Environment	Elements (X=Unsupportable by DIS PDUs)
_	Virtual and Live	Route Planning and	Time	This would require event report
upiosa, gownosa, rearm, exchange, transiosa		LRP-Selection Time,		PDUs of time of route-selection start
and docking in providing rue! and primary		Accuracy and	<ul> <li>Automated route-selection speed</li> </ul>	and stop.
armament munitions (except M712		Completeness	•Manual route-selection speed	
Copperhead, which may be handled manually)			• Automated LRP-selection speed	
to support the AFAS and to meet the		Number of FARV	• Manual LRP-selection speed	Entity state PDI
performance requirements specified. The		moves		
responsiveness of the AFAS is affected by the				
responsiveness of the FARV to resupply		Number of rounds		Resummly received PDI
requirements. The amount of time it takes to		delivered		
travel is a function of route planning and LRP				
selection time, as well as route "goodness."		Quantity of fuel		Entity state PDU
Since the RSOP decision aid reduces planning		delivered		
time and rapidly provides the most acceptable				
routes and LRPs, it positively influences both	•_	Quantity of other	Accuracy	Determined through post-exercise
FAKY and AFAS system responsiveness.		classes of supply		analysis
		delivered	Were the computer-selected and manually	•
-			selected routes navigable according to the	
		Number of FARVs	completeness criteria?	
		surviving		
			Were the computer-selected and manually	-
			selected LRPs acceptable according to the	
			completeness criteria?	

Subject of Experimentation/Testing: FARV Decision Aid-Reconnaissance, Selection and Occupation of Position (RSOP)

Specifications	Environments for	Measures of	Characteristics and Their Data	Existing, Modified or New DIS
	Testing/ Experimentation	Performance	Elements for Collection if DIS Virtual	PDUs Required to Collect Data
	- L		Environment	DIS PDUs)
Resupply (continued)			Completeness	These could be determined by post-
			The state of the s	exercise analysis of each of the
			salested soutes consider the following	Dulleted Items. I have Items Would
			criteria?	all be readily available in the existing
				NBC and Fuel Required. Fuel
			NBC contamination	required could be reported with an
			<ul> <li>Proximity to friendly units</li> </ul>	
			<ul> <li>Communications line of sight with higher</li> </ul>	
			headquarters and AFASs	by analyzing NBC threats
			•Overhead concealment	(represented as environmental
			•Overhead clearance	entities).
			•Time to complete movement	
			• Fuel required to complete movement	
			•Slope	
			Surface conditions	
			Threat	
			•Military obstacles	
			Did computer-selected and manually	
	-		selected LRPs consider the following	
			criteria?	
			• Entries and exits	
			Dimensions of clearings	
			Proximity to friendly units	
			•Communications line of sight with higher	
			headquarters and AFASs	
			•Recent use of the LRP (Counterfire)	
			• Slope	
			Surface conditions	
			• Threat	

2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment. Though decision aids are no longer considered a high-risk technology by military leaders, they still need to quantify the operational benefit of various decision-aid prototypes to justify the research and development expense associated with them. Both virtual and live simulations offer the opportunity for side-by-aide comparison testing of crews with and without these devices. The integration of decision aids also permits early soldier/user input as to how decision-aid performance might be improved. Ultimately, crews can be trained to better use fielded decision aids.

3. Required Resources. Decision-aid prototypes and interfaces, test and evaluation software to track decision-aid times and other variables, and, perhaps, video equipment to monitor crew performance.

Subject of Experimentation/Testing: FARV Decision Aid-Self Defense

Specifications	Environments for	Measures of Performance	Characteristics and	Evistine Modified or New DIS Polite
	Testing/		Their Data Elements	Required to Collect Data Elements
	Experimentation		for Collection if DIS	(X=Unsupportable by DIS PDUs)
			Virtual Simulation is	
			Appropriate Environment	
Survivability. The system will optimize its	Virtual or Live	Number of survivability moves, with and	Possible Sensor Types	Entity state PDU
probability of survival via tactics and		without DA (750 meters or less)		
appropriate susceptibility and vulnerability		Number of BABVe that committee of the	• Kadar • Inframed	
the crew in planning and conducting system		without DA	• Acoustic	cinity plane i DO
survivability operations by providing			• Magnetic	
recommendations for responses to counteract		Number of enemy contact reports, with and	Visual (Video camera) Signal PDU	Signal PDU
create self-defense plan, monitor and control			Optical Augmentation	- 17
its own signatures and activities, and monitor threat activity, ultimately choosing to stay and		Number of Battle Damage Assessment Reports, with and without DA	• Electro-Magnetic (Radio)	Signal PDU
fight the threat, or run or hide from it.		Range of threat at sensor detection time,	Kinds of FARV	Event report PDU
		ATTENDED TO THE STATE OF THE ST	o Brancies	
		Number of threat detection's by sensor type, with and without DA	• Infrared • Thovement • Noise • Radio Transmissions • Electromagnetic • Radiation • Visible Light • Incidental Signatures	Event report PDU
			Sources of threat information	
			•On-board sensors • Intelligence reports (displayed on FARV digital map)	
Training. Crew training level can be evaluated by tracking individual speed and accuracy in	Virtual or Live	Time	Time	
executing the commands and other functions associated with proper operation of the SD desiring and Accuracy is a function of			Command execution speeds	×
executing the commands in the proper			Acuracy	
			Correct operational sequencing	×

2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment. Though decision aids are no longer considered a high-risk technology by military leaders, they still next to quantify the operational benefit of various decision-aid prototypes to justify the research and development expense associated with them. Both virtual and live simulations offer the opportunity for side-by-side comparison testing of crews with and without these devices. The integration of decision aids also permits early soldier/user input as to how decision-aid performance might be improved. Ultimately, crews can be trained to better use fielded decision aids.

3. Required Resources. Decision-aid prototypes and interfaces, test and evaluation software to track decision-aid times and other variables, and, perhaps, video equipment to monitor crew performance.

# Subject of Experimentation/Testing: FARV Decision Aid-Embedded Training (ET) and ET During System Operations

Note: ET must be used in conjunction with the other components of the integrated decision enhancement system (DES). ET will not operate by itself to support crew manual operations. In addition, only the performance support component of ET can be evaluated in a virtual or live environment; therefore, the variables "ET during system operations" and "ET decision aid" are synonymous.

Existing, Modified or New DIS PDUs  Required to Collect Data Elements  (X=Unsupportable by DIS PDUs)  is	Event report PDU	Signal PDU	Pu	Signal PDU		Signal PDU				9	
Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Classes of Supply:  I Subsistence	II Clothing, individual	tool sets, tool kits, hand tools, housekeeping	supplies and equipment	III Petroleum fuels	IV Construction and barrier materials	V Ammunition	VI Personal demand items	VII Major end items	VIII Medical materials	IX Repair parts and components
Measures of Performance	Total quantity of each class of supply delivered, with and without MM DA	Total number of AFAS fire missions returned as unsupportable to the Platoon Operations Center (POC) for each class of	supply, with and without MM DA	Total number times the FARV rendered non-operational because of the lack of a class of supply, with and without MM DA	Visualization of maintaining of south	reports sent to the POC and LRP, with and without MM DA					
Environments for Testing/ Experimentation	Virtual or Live										
Specifications	Resupply in FARV Mission Management. The Virtual or FARV will provide AFAS with automated, under armor Class III (fuel) and Class V	(primary armament ammunition). Rapid, automated transfer operations will allow the system to rearm AFAS with ready-lo-fire firsed	projectiles, LP and fuel, eliminating manual ammunition processing and handling	requirements under normal FARV/ĀFAS operations. Other classes of supply may be manually cumplied to AFAS. The system will	use embedded decision aids to assist the crew	in managing our-toward inventories and resupply planning.					

Subject of Experimentation/Testing: FARV Decision Aid-Embedded Training (ET) and ET During System Operations

Specifications		Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified or New DIS PDUs Required to Collect Data Elements (X=Unsupportable by DIS PDUs)
Command, Control and Communications (C <sup>3</sup> ) in AFAS Fire Mission Processing. The system	Virtual or Live	For each mode of operation:		
shall be capable of centralized, decentralized and senior/subordinate modes of operation.		Total number of rounds fired, with and without DA		Fire PDU or Signal PDU (MFRs)
		Total number of fire missions returned as unsupportable to the Platoon Operations Center (POC), with and without DA		Signal PDU
		Number of fire missions returned as unsupportable to the POC for insufficient appropriate ammunition, with and without DA		Signal PDU
		Time fired and sequence of missions fired with fire order components listed, with and without DA	٠	Fire PDU and Event report PDU
		Total time required to execute each fire mission while in position, with and without DA		Event report PDU
		Total time required to execute each fire mission while moving, with and without DA		Event report PDU

Subject of Experimentation/Testing: FARV Decision Aid-Embedded Training (ET) and ET During System Operations

Specifications	Environments for	Measures of Performance	Characteristics and	Existing Madified or New DIC
	Testing/		Their Data Flements	PDI is Required to Collect Data
	Experimentation		for Collection if DIS	Elements (X=Unsupportable by
	•		Virtual Simulation is	DIS PDÚS)
			Appropriate Environment	
Command, Control and Communications (C3) in BABV Mission Management The surface	Virtual or Live	For each mode of operation:	Classes of Supply:	
shall be capable of certalized and		Total quantity of each class of supply delivered with and without MM DA	I Subsistence	Event report PDU
broad spectrum of communications			II Clothing, individual	
capabilities.		Number of maintenance and resupply reports sent to the POC and LRP, with and	equipment, tentage, tool sets, tool kits, hand	Signal PDU
		without MM DA	tools, housekeeping supplies and equipment	
			III Petroleum fuels	
			IV Construction and barrier materials	
			V Ammunition	
			VI Personal demand items	
			VII Major end items	
			VIII Medical materials	
			IX Repair parts and components	
Training. Crew training level can be evaluated by backing individual anged and accuracy in	Virtual or Live	Time	Time	
executing the commands and other functions associated with proper operation of the FMP			Command execution speeds	×
exclusion and commands in the proper			Accuracy	
			Correct operational sequencing	×

Subject of Experimentation/Testing: FARV Decision Aid-Embedded Training (ET) and ET During System Operations

Specifications	Environments for Testing/	Measures of Performance	Characteristics and Their Data Elements	Existing, Modified or New DIS PDUs Required to Collect Data
	Experimentation		for Collection if DIS Virtual Simulation is Appropriate Environment	Elements (X=Unsupportable by DIS PDUs)
Survivability in Route Planning and Site	Virtual or Live	Route Planning and LRP-Selection Time,	Time	This would require event report
probability of survival via tactics and		Completeness	• Automated route-	and stop.
appropriate susceptibility and vulnerability		•	selection speed	
reduction measures. The RSOP decision aid		Number of FARV moves	• Manual route-	
contains route planning, navigation and LRP			selection speed	Entity state PDU
selection capabilities that facilitate crew		Number of rounds delivered	• Automated LRP-	•
performance evaluation in a simulation			selection speed	Resupply received PDU
environment with and without the decision-		Number of FARVs	<ul> <li>Manual LRP-selection</li> </ul>	
aid capability. The RSOP decision aid contains		surviving	paads	Entity state PDU
algorithms and rules that help crew members				
by automatically considering threat line of			1	
sight, communications line of sight and other			Accuracy	Determined through post-exercise
tactical considerations involving digital terrain				analysis
elevation data; and other ractors that use			were the computer-	
Ligital mapping Agency summary terrain			selected and manually	
overlay intormetion to automatically evaluate position and i RPs without the crew's having to			selectic routes	
conduct reconnaissance or lengthy paper map			the completeness	
analyses.			criteria?	
			Were the computer-	
			selected and manually	
			according to the	
			completeness criteria?	

Subject of Experimentation/Testing: FARV Decision Aid-Embedded Training (ET) and ET During System Operations

Specifications	Environments for	Measures of Performance	Characteristics and	Existing, Modified or New DIS
	Testing/		Their Data Elements	PDUs Required to Collect Data
	Experimentation		Virtual Simulation is	Elements (X=Unsupportable by
			Appropriate	
			Environment	
Survivability (continued)			Completenese	These could be determined by post-
				exercise analysis of each of the
			Did computer-selected	bulleted items. Those items would
			and manually selected	all be readily available in the existing
			routes consider the	DIS versions with the exception of
			following criteria?	NBC and Fuel Required. Fuel
			ì	required could be reported with an
			NBC contamination	event report PDU. NBC
			Proximity to friendly	contamination could be determined
			units	by analyzing NBC threats
			•Communications line	•Communications line (represented as environmental
			of sight with higher	entities).
			headquarters and	
			AFASs	
			•Overhead	
			concealment	
			Overhead clearance	
•			•Time to complete	
			movement	
			<ul> <li>Fuel required to</li> </ul>	
			complete movement	
			•Slope	
			<ul> <li>Surface conditions</li> </ul>	
			• Threat	
			<ul> <li>Military obstacles</li> </ul>	

Subject of Experimentation/Testing: FARV Decision Aid-Embedded Training (ET) and ET During System Operations

and Existing, Modified or New DIS nents PDUs Required to Collect Data I DIS Elements (X=Unsupportable by DIS PDUs)  e		cted	tion	s line er	LRP ns
Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Completeness (continued)	Did computer-selected and manually selected LRPs consider the following criteria?	NBC contamination     Entries and exits     Dimensions of clearings     Proximity to friendly	Communications line     Sight with higher     headquarters and     AFASs	Recent use of the LRP (Counterfire)     Slope     Surface conditions     Threat
Measures of Performance					
Environments for Testing/ Experimentation					
Specifications	Survivability (continued)				

Subject of Experimentation/Testing: FARV Decision Aid-Embedded Training (ET) and ET During System Operations

Specifications	Environments for	Measures of Performance	Characteristics and	Existing, Modified or New DIS
	Experimentation		for Collection if DIS Virtual Simulation is Appropriate	FDDs Required to Collect Data Elements (X=Unsupportable by DIS PDUs)
Survivability in Self Defense. The system will	Virtual or Live	Number of survivability moves, with and	Environment Possible Sensor Types	Entity state PDU
optimize its probability of survival via facility and appropriate susceptibility and vulnerability reduction measures. Decision aids will assist the crew in planning and		Number of FARVs that survive, with and without DA	•Radar •Infrared •Acoustic	Entity state PDU
conducting system survivability operations by providing recommendations for responses to counteract identified threats. To survive, the		Number of enemy contact reports, with and without DA		Signal PDU
FARV must create self-defense plan, monitor and control its own signatures and activities, and monitor threat activity, ultimately		Number of Battle Damage Assessment Reports, with and without DA	•Optical Augmentation •Electro-Magnetic (Radio)	Signal PDU
choosing to stay and right the unreat, or run or hide from it.		Range of threat at sensor detection time, with and without DA	Kinds of FARV Signatures	Event report PDU
		Number of threat detection's by sensor type, with and without DA	• Infrared • TMovement • Noise • Radio Transmissions • Electromagnetic • Radiation • Visible Light	Event report PDU
			Sources of threat information	
			•On-board sensors •Intelligence reports (displayed on FARV digital map)	

Subject of Experimentation/Testing: FARV Decision Aid-Embedded Training (ET) and ET During System Operations

Existing, Modified or New DIS PDUs Required to Collect Data Elements (X=Unsupportable by DIS PDUs)	Pire PDU or Signal PDU (MPRs)	Signal PDC	Signal PDU	Fire PDU and Event report PDU	Event report PDU	Event report PDU
Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment					_	
Measures of Performance	Total number of rounds fired, with and without DA	Lotal number of tire missions returned as unsupportable to the Platoon Operations Center (POC), with and without DA	Number of fire missions returned as unsupportable to the POC for insufficient appropriate ammunition, with and without DA	Time fired and sequence of missions fired with fire order components listed, with and without DA	Total time required to execute each fire mission while in position, with and without DA	Total time required to execute each fire mission while moving, with and without DA
Environments for Testing/ Experimentation	Virtual or Live					
Specifications	Responsiveness in Fire Mission Processing. Though the AFAS is always available to shoot fire missions in support of the maneuver	commander, i.e., while on the move or emplaced, the system's responsiveness is affected by the crew's ability to respond rapidly to the next priority mission request. The	required response time while in position is within 20 seconds; the response time while moving is within 45 seconds.			

Subject of Experimentation/Testing: FARV Decision Aid-Embedded Training (ET) and ET During System Operations

Existing, Modified or New DIS PDUs Required to Collect Data Elements (X=Unsupportable by DIS PDUs)	Signal PDU and Fire PDU  Event report PDU  Signal PDU	Signal PDU Signal PDU	
Characteristics and Example Their Data Elements From Collection if DIS Electron Simulation is Appropriate Environment	idual e, hand	III Petroleum fuels Sig.  IV Construction and barrier materials V Ammunition Sig. VI Personal demand items	VII Major end items VIII Medical materials IX Repair parts and components
Measures of Performan. 2	Without MM DA  Total quantity of each class of supply delivered, with and without MM DA  Total number of APAS fire missions returned as unsupportable to the Platoon Operations Center (POC) for each class of supply, with and without MM DA  Total number of APAS fire missions contex (POC) for each class of supplies and equipment	Total number times the FARV rendered non-operational because of the lack of a class of supply, with and without MM DA Number of maintenance and resupply reports sent to the POC and LRP, with and without MM DA	
Environments for Testing/ Experimentation	Virtual or Live		
Specifications	Responsiveness in FARV Mission Management. Though the AFAS is always available to shoot fire missions in support of the maneuver commander, i.e., while on the move or emplaced, the AFAS's responsiveness is affected by the FARV's ability to resupply. The required AFAS fire mission response time while in position is within 20 seconds; the response time while moving is within 45 seconds.		

Subject of Experimentation/Testing: FARV Decision Aid-Embedded Training (ET) and ET During System Operations

Existing, Modified or New DIS PDUs Required to Collect Data Elements (X=Unsupportable by DIS PDUs)	This would require event report PDUs of time of route-selection start and stop.  Entity state PDU Resupply received PDU Entity state PDU Determined through post-exercise analysis
Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Time  • Automated route- selection speed • Manual route- selection speed • Automated LRP- selection speed • Manual LRP-selection speed  Accuracy  Were the computer- selected and manually selected routes navigable according to the completeness criteria?  Were the computer- selected and manually
Measures of Performance	Route Planning and Site Selection Time, Accuracy and Completeness  Number of FARV moves  Number of FARVs  surviving
Environments for Testing/ Experimentation	Virtual or Live
Specifications	Responsiveness in Route Planning and Site Selection. The responsiveness of the ARAS is affected by the responsiveness of the FARV to resupply requirements. The amount of time it takes to travel is a function of route planning and LRP selection time, as well as route "goodness." Since the RSOP decision aid reduces planning time and rapidly provides the most acceptable routes and LRPs, it positively influences both FARV and AFAS system responsiveness.

Subject of Experimentation/Testing: FARV Decision Aid-Embedded Training (ET) and ET During System Operations

Measures of Performance
Did computer-selected
and manually selected
routes consider the
following criteria?
NBC contamination
Proximity to friendly
units
•Communications line
of sight with higher
AFASs
Overhead
concealment
Overhead clearance
• Time to complete
movement
• Fuel required to
complete movement
• Slope
Surface conditions
• Threat
Military obstacles

Subject of Experimentation/Testing: FARV Decision Aid-Embedded Training (ET) and ET During System Operations

Existing, Modified or New DIS PDUs Required to Collect Data Elements (X=Unsupportable by DIS PDUs)							
Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Completeness (continued)	Did computer-selected and manually selected LRPs consider the following criteria?	NBC contamination     Entries and exits     Dimensions of clearings.	• Proximity to friendly units • Communications line	of sight with higher headquarters and APASs	•Recent use of the LRP (Counterfire)	•Slope •Surface conditions •Threat
Measures of Performance							
Environments for Testing/ Experimentation							
Specifications	Responsivences (continued)						

Subject of Experimentation/Testing: FARV Decision Aid-Embedded Training (ET) and ET During System Operations

Specifications	Environments for	Measures of Performance	Characteristics and	Existing, Modified or New DIS
	Experimentation		for Collection if DIS	Elements (X=Unsupportable by
			Appropriate Environment	
Responsivenees in Sustainment Operations. Though the AFAS is always available to shoot	Virtual or Live	AFAS fire mission response time, with and Classes of Supply: without DA	Classes of Supply:	Signal PDU and Fire PDU
fire missions in support of the maneuver			I Subsistence	
commander, i.e., while on the move or		Total quantity of each class of supply		Event report PDU
emplaced, the AFAS's responsiveness is		delivered, with and without DA	II Clothing, individual	•
affected by its ability to maintain and resupply			equipment, tentage,	
itself. The required AFAS fire mission		Total number of AFAS fire missions	tool sets, tool kits, hand Signal PDU	Signal PDU
response time while in position is within 20		returned as unsupportable to the Platoon	tools, housekeeping	
seconds; the response time while moving is		Operations Center (POC) for each class of	supplies and	
within 45 seconds.		supply, with and without DA	equipment	
		Total number times the AFAS rendered	III Petroleum fuels	
		non-operational because of the lack of a		Signal PDU
		class of supply, with and without DA	IV Construction and	
			barrier materials	
		Number of maintenance and resupply reports sent to the POC, LRP and FARV,	V Ammunition	Signal PDU
		with and without DA		
			VI Fersonal demand items	
			VII Major end items	
			VIII Medical materials	
			IX Repair parts and components	

Subject of Experimentation/Testing: FARV Decision Aid-Embedded Training (ET) and ET During System Operations

Specifications	Environments for	Measures of Performance	Characteristics and	Existing Modified or New DIS
	Testing/		Their Data Elements	PDUs Required to Collect Data
	Experimentation		for Collection if DIS	Elements (X=13nsupportable by
	•		Virtual Simulation is	DIS PDUs)
			Appropriate	
Resupply (Route Planning and Site Selection).	Virtual and Live	Route Planning and LRP-Selection Time.	Time	This would require event report
_		Accuracy and		PDUs of time of route-selection start
download, rearm, exchange, transload and		Completeness	•Automated route-	and stop.
docking in providing fuel and primary		•	selection speed	
armament munitions (except M712		Number of PARV moves	• Manual route-	
Copperhead, which may be handled manually)			selection speed	Entity state PDU
to support the AFAS and to meet the		Number of rounds delivered	<ul> <li>Automated LRP-</li> </ul>	•
performance requirements specified. The			selection speed	Resupply received PDU
responsiveness of the AFAS is affected by the		Quantity of fuel delivered	<ul> <li>Manual LRP-selection</li> </ul>	
responsiveness of the FARV to resupply			paads	Entity state PDU
requirements. The amount of time it takes to		Quantity of other classes of supply	•	•
travel is a function of route planning and LRP		delivered		Entity state PDU
selection time, as well as route "goodness."				
Since the RSOP decision aid reduces planning		Number of FARVs		
time and rapidly provides the most acceptable		surviving		Entity state PDU
routes and LRPs, it positively influences both				
FARV and AFAS system responsiveness.			Accuracy	Determined through post-exercise
			44	
			selected and manually	
			selected nortes	
			navigable according to	
			The completeness	
			Criteria	
			Were the computer-	
			selected and manually	
			selected LRPs acceptable	
			according to the	
			completeness criteria?	

Subject of Experimentation/Testing: FARV Decision Aid-Embedded Training (ET) and ET During System Operations

Existing, Modified or New DIS By PDUs Required to Collect Data S Elements (X=Unsupportable by DIS PDUs)	These could be determined by post- exercise analysis of each of the bulleted items. Those items would all be readily available in the existing DIS versions with the exception of NBC and Fuel Required. Fuel required could be reported with an event report PDU. NBC contamination could be determined by analyzing NBC threats (represented as environmental entities).
Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Completeness  Did computer-selected and manually selected routes consider the following criteria?  NBC contamination  Proximity to friendly units  Communications line of sight with higher headquarters and AFASs  Overhead complete movement  Overhead clearance  Time to complete movement  Fuel required to complete movement  Slope  Surface conditions  Thing to complete movement  Slope  Surface conditions  Thing to complete movement  Slope  Surface conditions
Measures of Performance	
Environments for Testing/ Experimentation	
Specifications	Resupply (continued)

Subject of Experimentation/Testing: FARV Decision Aid-Embedded Training (ET) and ET During System Operations

d Existing Modified or New DIS ts PDUs Required to Collect Data S Elements (X=Unsupportable by is DIS PDUs)				9		Δ.	
Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Completeness (continued)	Did computer-selected and manually selected LRPs consider the following criteria?	NBC contamination     Entries and exits     Dimensions of	• Proximity to friendly units • Communications line	of sight with higher headquarters and AFASs	•Recent use of the LRP (Counterfire)	<ul><li>Slope</li><li>Surface conditions</li><li>Threat</li></ul>
Measures of Performance							
Environments for Testing/ Experimentation							
Specifications	Resupply (continued)						

Subject of Experimentation/Testing: FARV Decision Aid-Embedded Training (ET) and ET During System Operations

Specifications	Environments for Testing/	Measures of Performance	Characteristics and Their Data Riements	Existing, Modified or New DIS	
	Experimentation		for Collection if DIS Virtual Simulation is Appropriate Environment	Elements (X=Unsupportable by DIS PDUs)	•
Resupply (Sustainment). The AFAS Sustainment decision aid (DA) will provide	Virtual or Live	Total quantity of each class of supply delivered, with and without DA	Classes of Supply:	Event report PDU	
performance support in the areas of		6	1 Subsistence		
records management, requisitioning and the	-	iotal number of fire missions returned as unsupportable to the Platoon Operations	II Clothing, individual	Signal PDU	
creation and maintenance of crew rotation schedules. Applicable functions apply to all		Center (POC) for each class of supply, with and without DA	equipment, tentage, tool sets, tool kits, hand		
classes of supply.			tools, housekeeping		
		Total number times the AFAS rendered	supplies and	Signal PDU	
		class of supply, with and without DA	nichulanha		
			III Petroleum fuels		
		reports sent to the POC, LRP and FARV,	IV Construction and	Signal PDU	
		with and without DA	barrier materials		
		Total number of missions fired, with and	V Ammunition	Signal PDU	
			VI Personal demand items		
			VII Major end items	-	
	-		VIII Medical materials		
			IX Repair parts and components		

2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment. Though decision aids are no longer considered a high-risk technology by military leaders, they still new to quantify the operational benefit of various decision-aid prototypes to justify the research and development expense associated with them. Both virtual and live simulations offer the opportunity for side-by-side comparison testing of crews with and without these devices. The integration of decision aids also permits early soldier/user input as to how decision-aid performance might be improved. Ultimately, crews can be trained to better use fielded decision aids.

3. Required Resources. Decision-aid prototypes and interfaces, test and evaluation software to track decision-aid times and other variables, and, perhaps, video equipment to monitor crew

performance.

Subject of Experimentation/Testing: AFAS Sensor Assets to Support Self Defense

5 th (c)	a ge ed d			
Existing, Modified or New DIS PDUs Required to Collect Data Elements (X=Unsupportable by DIS PDUs)	The Emission PDU and Distributed Emission Regeneration can be used for simulating the SD sensor suite functions. However, NBC threats should be represented as environmental entities (Entity state PDU).	Entity state PDU	Signal PDU	Signal PDU
Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Ground Attidentify any wheeled an a range of 5 ldentificati radar-based (fransponder range of 10 vehicle to 1 signal with assumption sensor that munitions to a range of t	Laser Sensor. Detects presence of transmitted laser energy on AFAS hull	NBC Sensor. Detects presence of all known NBC contaminants	
Measures of Performance	Number, kind, range, location and rate of advance of friendly and enemy (personnel, vehicular, air-delivered munition and aircraft) sensings from any of the following kinds of sensors projected for use on the AFAS: Radar • Infrared • Acoustic • Magnetic • Visual (Video camera) • Visual (Video camera) • Visual Augmentation • Electro-Magnetic (Radio)	Number of AFASs surviving, with and without each sensor or combination of sensors	Number of AFAS BDAR NBC Sensor. Detects preserve reports, with and without each known NBC contaminants sensor or combination of sensors	Kinds of battle damage reported, with and without each sensor or combination of sensors
Environments for Testing/ Experimentation	Virtual or Live			
Specifications	Survivability. The system will optimize its probability of survival via factics and appropriate susceptibility and vulnerability reduction measures. Decision aids will assist the crew in planning and conducting system survivability operations by providing recommendations for responses to counteract identified threats. To survive, the AFAS must create a self-defense plan, monitor and control its own signatures and activities, and monitor threat activity, ultimately choosing to stay and fight the threat, or run or hide from it.			

Subject of Experimentation/Testing: AFAS Sensor Assets to Support Self Defense

Specifications	Environments for Testing/ Experimentation	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified or New DIS PDUs Required to Collect Data Elements (X=Unsupportable by DIS PDUs)
Survivability (continued)			Air Attack/Counterfire Sensor. A radar-based sensor with two modes: external and internal. The external mode based on counterfire radar input of impact grid location of incoming indirect fire to the AFAS. The counterfire radar, itself, has a range of approx. 50 km LOS. The internal mode detects aircraft and counterfire rounds out to a range of 10 km LOS.	
			Acoustic Sensor. Provides external ear, when AFAS buttoned up, out to a range of about 15 km for helicopter and aircraft engines.  Laser Range Finder. Determines range out to about 10,000 meters. Tied to direct-fire mission.	
Survivability (continued)			Television/IR Viewer. IR for night operations. TV camera can be slaved to other sensors for visual confirmation with a 6400 mil observation, elevation min50 mils/max. +600 mils, day or night.	
			Radio. The SINCGARS radio becomes a sensor for self defense insofar as it provides intelligence information and friendly disposition information.	
Training. Crew training level can be evaluated by tracking individual speed and accuracy in executing the commands and other functions associated with proper operation of the sensors controlled by the SD decision aid. Accuracy is a function of executing the commands in the proper sequence.	Virtual or Live	Time Accuracy	Time Command execution speeds Accuracy Correct operational sequencing	××

- 2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment. Planners have thus far collected very little data on the value of sensors on board the AFAS. By simulating detection or detecting the presence of friendly and enemy elements and attack munitions with varied combinations of sensors, these military planners can make supported judgments about which sensors provide the most value, and in which scenarios. Further, they can examine AFAS survivability rates with and without each of the sensors.

  3. Required Resources. DIS PDUs that simulate the characteristic data collection capabilities of each of these sensors and actually report the presence of friendly and enemy elements, or actual Sintegrated sensor suites used in live simulation.

Subject of Experimentation/Testing: FARV Sensor Assets to Support Self Defense

Specifications	Environments for	Messures of Performance	Characteristics and Their Data	Existing Madified or New DIS POILS
•	Testing/		Elements for Collection if DIS	Required to Collect Data Elements
	Experimentation		Virtual Simulation is Appropriate	(X=Unsupportable by DIS PDUs)
6	113.4.5.	-	Environment	
Survivability, the system will opininge to	A Islan Of LIVE	Number, King, range, joeanon	denuncation ruend of roc (ifr). A	The Emission FDC and Distributed
procedurity of survival via tecting and		-	radar-based transmitter/receiver	Emission Regeneration can be used
appropriate susceptionity and vunerability			(irainsponder) system with a LOS-	for stimulating the 5D sensor suite
reduction measures. Decision ands Will assist		_	range of 10-12 km. Fallure of target	runctions. However, NPC threats
the crew in planning and conducting system			venicle to recognize transmitted	should be represented as
survivability operations by providing			signal within 3 seconds results in	environmental entities (Entity state
recommendations for responses to counteract		2	assumption vehicle is unfriendly	PDU).
identified threats. To survive, the FARV must		d for use on the		
create a self-defense plan, monitor and control			Millimeter Wave Radar. A passive	
its own signatures and activities, and monitor			sensor that detects presence of smart	
threat activity, ultimately choosing to stay and			munitions and airborne radars out	
right the threat, or run or hide from it.		• Magnetic	to a range of approximately 18 km.	
		• Visual (Video camera)		
			Not Sensor. Letects presence of all	
		Optical Augmentation	Known MDC containingnis	
			A constitution of the contract of the contract of	
			Acoustic Sensor. Provides external	
		-	ear, when FAKV buttoned up, out to	
		_	a range of about 15 km for helicopter	Entity state PDU
		205	and aircraft engines.	
		or combination of sensors		
			Television/IR Viewer. IR for night	
			operations. TV camera can be	
		each	slaved to other sensors for visual	Signal PDU
		sensor or combination of	confirmation with a 6400 mil	
		sensors	observation, elevation min50	
			mils/max. +600 mils, day or night.	
		Kinds of battle damage		
		each sensor or combination of		
		sensors		
Survivability (continued)			Radio. The SINCGARS radio	
			becomes a sensor for self defense	
			insofar as it provides intelligence	
			information information	
Training. Crew training level can be evaluated	Virtual or Live	Time	Time	
by tracking individual speed and accuracy in		2		
executing the commands and other functions			Command execution speeds	×
associated with proper operation of the sensors			•	
controlled by the SD decision aid. Accuracy is a		-	Accuracy	
runction of executing the commands in the			Correct operational sections	*
אומינים שבל וענוורם:				<

- 2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment. Planners have thus far collected very little data on the value of sensors on board the PARV simulating detection or detecting the presence of friendly and enemy elements and attack munitions with varied combinations of sensors, these military planners can make supported judgments, about which sensors provide the most value, and in which scenarios. Further, they can examine PARV survivability rates with and without each of the sensors.

  3. Required Resources. DIS PDUs that simulate the characteristic data collection capabilities of each of these sensors and actually report the presence of friendly and enemy elements, or actually integrated sensor suites used in live simulation.

Subject of Experimentation/Testing: AFAS Countermeasures Suite 1. Data Collection Requirements

· · · · · · · · · · · · · · · · · · ·				
Existing, Modified or New DIS PDUs Required to Collect Data Elements (XnUnsupportable by DIS PDUs)	An NBC casualty would be reported via an event response PDU An interior decontamination operation would be reported via an event report PDU	Event response PDU	Detonation PDU	Detonation PDU
Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Countermeasure Elements:  NBC Defense Suite. Detects presence of all known NBC contaminants and includes NBC detection, warning, filtration and environmental conditioning systems.  Main Gun Direct Fire Suite. The main gun works in conjunction with the laser range finder to support defensive operations controlled by the AFAS Chief of ecritical Direct fire units the main	gun can achieve a range of about 5km.		
Messures of Performance	Number of NBC casualties reported, with and without the NBC defense suite (for comparison testing with and without the NBC system on board)  Number of AFAS interior decontamination operations reported, with and without NBC defensive suite (for comparison testing with and without the NBC system on board)	Time of activation of the NBC defensive suite	Number of direct-fire hits, with and without SD DA and laser range finder support of the main gun	Number of 20/30mm kills, with and without SD DA support
Environments for Testing/ Experimentation	Virtual or Live			
Specifications	Survivability. The system will optimize its probability of survival via tactics and appropriate susceptibility and vulnerability reduction measures. Decision aids will assist the crew in planning and conducting system survivability operations by providing recommendations for responses to counteract identified threats. To survive, the AFAS must create a self-defense plan, monitor and control its own signatures and activities, and monitor threat activity, ultimately choosing to stay and fight the threat, or run or hide from it.			

Subject of Experimentation/Testing: AFAS Countermeasures Suite

Specifications	Environments for	Measures of Performance	Characteristics and Their Data	Existing, Modified or New DIS
•	Testing/		Elements for Collection if DIS	PDUs Required to Collect Data
	Experimentation		Virtual Simulation is Appropriate Environment	Elements (X=Unsupportable by DIS PDUs)
Survivability (continued)		Number of AFASs surviving,	Secondary Armament. The 20 or 30	Entity state PDU
		with and without each	mm machine-gun (cannon) will	
		countermeasure element or	provide additional direct-fire	
		combination of	capability to a range of about 1 km.	
		countermeasure elements	It operates with the laser range	
		Number of ABAS BDAR	inder abo.	
		reports with and without each	Smoke Grenade	Gional PDI
		countermeasure element or	Launcher/Generator. The smoke	
		combination of	grenade launcher is tied to the SD	
		countermeasure elements	DA, launching defensive smoke	
			whenever the engine is not	
		Kinds of battle damage	running. When engine is running.	
		reported, with and without	a separate smoke generator will	Signal PDU
		each countermeasure element	produce defensive smoke. Both	·
		or combination of	systems generate an immediate	
		countermeasure elements	cloud of radius 25 m in 5 sec., 50 m	
			in 10 sec., 75 m in 15 sec., and 100m	
		Type and characteristics of	in 20 sec. Systems may be used	
		enemy munition causing	together to generate a larger cloud.	Detonation PDU
		damage.		
			Chaff Launcher. The chaff launcher	
			provides radar clutter to confuse or	
			defeat microwave radar, or confuse	
			laser-noming guioed munitions and	
			orner types of sensor-ruzed weapons.	
			The fauncher creates a chart bubble	
			Of 100m diameter in 2 sec. The 3D	
			second and encompling manufacility	
			necessary.	
Training. Crew training level can be evaluated	Virtual or Live	Time	Time	
by tracking individual speed and accuracy in		Accuracy	•	
executing the commands and other functions			Command execution speeds	×
associated with proper operation of the				
Countermeasure components controlled by the			Accuracy	
executing the commands in the proper			Correct operational sequencing	×
sednence.				

- 2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment. Planners have thus far collected very little data on the value of countermeasure elements. Applying defensive and offensive operations with varied combinations of countermeasure elements, these military planners can make supported judgments about which countermeasure elements. By simulating defensive and in which scenarios. Further, they can examine ARAS survivability rates with and without each of the countermeasure elements.

  3. Required Resources. DIS PDUs that simulate the characteristic effects of each of these countermeasure elements and actually report the enemy and friendly casualties and vehicular damage, or Clark thereof. Actual countermeasure elements can also be used in live simulation.

Subject of Experimentation/Teating: FARV Countermeasures Suite 1. Data Collection Requirements

Existing, Modified or New DIS PDUs Required to Cellect Data Elements (X=Unsupportable by DIS PDUs)	An NBC casualty would be reported via an event response PDU An interior decontamination operation would be reported via an event report PDU Event response PDU	Detonation PDU Detonation PDU	Entity state PDU Signal PDU Signal PDU Detonation PDU
Characteristics and Their Data Rements for Collection if DIS Virtual Simulation is Appropriate Environment	Countermeasure Elements:  NBC Defense Suite. Detects presence of all known NBC contaminants and includes NBC detection, warning, filtration and environmental conditioning systems.  Secondary Armament. The 20 or 30 mm machine-gun (cannon) will provide additional direct-fire capability to a range of about 1 km. It operates with the laser range		Smoke Grenade Launcher/Generator. The smoke grenade launcher is tied to the SD DA, launching defensive smoke whenever the engine is running, a separate smoke generator will produce defensive smoke. Both systems generate an immediate cloud of radius 25 m in 5 sec., 50 m in 10 sec., 75 m in 15 sec., 4nd 100m in 20 sec. Systems may be used together to generate a larger cloud. Chaff Launcher. The chaff launcher provides radar clutter to confuse or defeat microwave radar, or confuse laser-homing guided munitions and other types of senor-fuzed weapons. The launcher creates a chaff bubble of 100m diameter in 2 sec. The SD DA will determine when to fire the second and succeeding rounds, if
Measures of Performance	Number of NBC casualties reported, with and without the NBC defense suite (for comparison testing with and without the NBC system on board)  Number of FARV interior decontamination operations reported, with and without NBC defensive suite (for comparison testing with and without the NBC system on board)  Time of activation of the NBC		Number of FARVs surviving, with and without each countermeasure element or combination of countermeasure elements  Number of FARV BDAR reports, with and without each countermeasure element or combination of countermeasure elements  Kinds of battle damage reported, with and without each countermeasure element or combination of countermeasure element or combination of countermeasure elements  Type and characteristics of enemy munition causing damage.
Environments for Testing/ Experimentation	Virtual or Live		
Specifications	Survivability. The system will optimize its probability of survival via tactics and appropriate susceptibility and vulnerability reduction measures. Decision aids will assist the crew in planning and conducting system survivability operations by providing recommendations for responses to counteract identified threats. To survive, the FARV must create a self-defense plan, monitor and control its own signatures and activities, and monitor threat activity, ultimately choosing to stay and fight the threat, or run or hide from it.		Survivability (continued)

Subject of Experimentation/Testing: FARV Countermeasures Suite

Specifications	Environments for	Measures of Performance	Characteristics and Their Data	Environments for Measures of Performance   Characteristics and Their Data   Existing, Modified or New DIS
	Testing/		Elements for Collection if DIS	PDUs Required to Collect Data
	Experimentation		Virtual Simulation is	Elements (X=Unsupportable by
			Appropriate Environment	DIS POUS)
Training. Crew training level can be evaluated   Virtual or	Virtual or Live	Time	Time	
by tracking individual speed and accuracy in		Accuracy		
executing the commands and other functions		•	Command execution speeds	×
associated with proper operation of the			•	
countermeasure components controlled by the			Accuracy	
SD decision aid. Accuracy is a function of			•	
executing the commands in the proper			Correct operational sequencing	×
seduence.				

2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment. Planners have thus far collected very little data on the value of countermeasure elements and offensive and offensive operations with varied combinations of countermeasure elements, these military planners can make supported judgments about which countermeasure elements provide the most value, and in which scenarios. Further, they can examine FARV survivability rates with and without each of the countermeasure elements.

3. Required Resources. DIS PDUs that simulate the characteristic effects of each of these countermeasure elements and actually report the enemy and friendly casualties and vehicular damage. A lack thereof. Actual countermeasure elements can also be used in live simulation.

Subject of Experimentation/Testing: AFAS Firing Position

ons	Environments for Testing/ Experimentation	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified or New DIS PDUs Required to Collect Data Elements (X=Unsupportable by DIS PDUs)
sition Parameters	Live Test	A 2	Combination of quadrant of elevation, azimuth, charge, and ground slope at the firing position.	×
Tube QE -3 to +75 Degrees from vehicle centerline.		depressed to the specified limits?	Collect static and dynamic loads on the vehicle and vehicle suspension for each combination of charge, azimuth of fire, elevation and slope.	_×
		Can the gun be fired at every	•	
		of elevation, deflection and		
		without damage to the system or loss of accuracy?		
Firing Position Parameters	Virtual	Targets can be	Terrain Slope.	Event report PDU
errain Stope -10 to +10 Degree Maximum resultant slope.		engaged at all	Azimuth to the target.	Event report PDU
			Quadrant of elevation for the gun.	Event report PDU
		+10 degrees.	Charge/distance to the target.	Event report PDU
			Determined target location.	Detonation PDU
			Place round should hit.	Detonation PDU
			Place where round did hit.	Detonation PDU
			Numbers of rounds fired.	Detonation PDU
Rearm Vehicle Mis-alignment Allowances.	Live	Can the APAS	Terrain slope.	Event report PDU
vehicles		every	Resultant angle between both vehicles.	Entity state PDU
		of resultant	Time resupply started.	Event report PDU
		without	Time resupply ended.	Event report PDU
		system or loss of automatic	Amount of supplies transferred.	Entity state PDU
		rearm capability?		

Subject of Experimentation/Testing: AFAS Firing Position

Specifications	Environments for Testing	te for Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate	9 -
Darren Darriston Darrenstone	r inc	San la minuscription de la San Albanda de la San	Touris slow	CA-Uneupportable by DIS PDUS
	בואני	ביים מושי	icitain arche.	event report rico
Slopes <= 60% longitudinal and <=40% lateral		be rearmed at		
•		degree of	Resultant angle between both vehicles.	Entity state PDU
		terrain slope		•
		without	Time resupply started.	Event report PDU
		damage to the	`	•
			Time resupply ended.	Event report PDU
		of automatic	•	•
		rearm	Amount of supplies transferred.	Entity State PDU
		capability		•
		within the		
		values		
		specified in		
		the first		
		column?		

X(1). Note: DIS Simulation could provide an appropriate environment for testing and evaluation, however data on the DIS network would not generally support the measurements needed.

- 2. Technical and Operational Benefits of Experimentation with Firing and Rearm Position Parameters
- relative to the horizontal centerline if the vehicle. The AFAS and FARV will be able to exchange ammunition, fuel and propellant without any of the crew from either vehicle leaving the crew Stated specifications. The AFAS will be able to aim and fire the primary weapon from terrain with slopes of -10° to +10°. The gun tube can be elevated to +75°, or depressed to -3° cabs of their respective vehicles, with a misalignment between vehicles of 10° or less.
- 2.2 Other Aspects of Performance Measurable in a DIS Virtual Environment. N/A.
- Analysts and testers can run the same experiment repeatedly, incrementally altering designs to determine operational and technical tradeoffs offered by alternative crew station configurations, soldier-machine interfaces (SMIs), BCC designs, and DIS environment or a combination of the two. A single Sample Experiment. There are several types of experiments that can be accomplished either in softwar experiment/scenario in the DIS virtual environment can address each of the specifications of performance outlined autoloading designs/times.

Ē For example, if the autoloader emulation software has an interactive, selectable autoloading time, the impact of various autoloading designs on overall mission response time and rate of requirements may be determined.

component capabilities to determine the best fit to meet overall response time and rate of fire requirements. If the fidelity of the ammunition transfer and autoloader is high enough, the tester and installation of a virtual ammunition transfer and autoloader prototype in the AFAS simulator provides the opportunity to experiment with various SMIs, software design architectures, could investigate the ability of the system to transfer ammunition when the AFAS and FARV are situated on terrain that have steep slopes. Emulating the main gun tube elevation and traversing capabilities will allow the investigation into the combined effects of recoil and slope on stresses in the suspension system. If there are adverse effects, then the emulation software can be restricted so that there are no adverse effects and then determine the impact of the restrictions on mission effectiveness in a DIS scenario. The overall impact of design changes can be measured in terms of the battle outcomes at the conclusion of the experiment/scenario.

- 3. Required Resources. To support experimentation and testing in the areas identified above the following resources are required:
- One AFAS crew to man an AFAS simulator
- One AFAS simulator equipped with BCC, radios, modems, crew stations, crew displays, supporting software, with access to M712 Copperhead rounds in the ammunition storage area
- One observer to acquire and submit calls for fire to engage opposition force targets on the virtual battlefield
- One fire direction computer operator
- One AFATDS POC computer to process the observer's call for fire during centralized AFAS operations, automatically relay calls for fire during decentralized operations, and update AFAS information base on fire support coordination measures and battlefield geometry, meteorological data, and preplanned targets.
- One AFAS SAFOR to support senior to subordinate AFAS operations
- Threat SAFOR operations order
- Threat SAFOR to execute the order
- Friendly force operations order with fire support coordination measures and battlefield geometry
- Friendly SAFOR to execute the order
- 4. Emulators Required. The following models or emulations will be needed to support the AFAS simulator.
- 1. Primary gun emulation packages consisting of models representing a traversing turret and transmission/electric/hydraulic tube elevating unit and aiming mechanism.
  - Primary chassis and suspension emulation packages consisting of models representing springs/torsion bars, road wheels, tracks and track pads
- Chassis model (in software) consisting of chassis, turret, gun tube, crew cab, etc. Primary interest in the DIS testing is in the chassis-gun tube configuration and interaction with the chassis when the gun is fired.

4. Ammunition transfer and loading system.

4. Ammunition transfer and loading system.

5. Power management system consisting of appropriate power sources, and control devices. Some of the devices must be crew accessible inside the simulator and will require a high CALL fidelity emulation.

Subject of Experimentation/Testing: FARV Resupply Position Parameter Suitability

1. Data Collection Requirements

ading ading ading ading acted transfer transfer transfer to the etd or nitton nit and nit he etween nittees the etween cy?  The et of the cor loss by the cor loss the cor los		Required to Collect Data Elements
gnment Virtual Resupply transloading site selected allows transfer of ammunition without human handling.  Gneet an ammunition be loaded or transferred at every combination of terrain and resultant angle between the vehicles within the specified limits without loss of system efficiency?  In can the FARV transload munitions and supplies at degree of terrain slope without damage to the system or loss of automatic rearm capability within the	Environment	(X = Insupportable by DIS PDUs)
allows transfer of ammunition without human handling.  S Vehicle Mis-alignment Virtual supplies and ammunition be loaded or transferred at every combination of terrain and resultant angle between the vehicles within the specified limits without loss of system of terrain slope without damage to the system or loss of automatic rearm capability within the system or loss of automatic rearm capability within the system or loss of automatic rearm capability within the within the system or loss of automatic rearm	Try different configurations of visibility, mating and ammunition handling equipment.	X(1).
S Vehicle Mis-alignment  S Vehicle Mis-alignment  S Vehicle Mis-alignment  S Vehicle Mis-alignment  Daximum resultant angle between  I ransferred at revery  Combination  Of terrain and resultant angle between  The vehicles  Within the specified  I limits without  I loss of system  I live  Can the FARV  Transload  Munitions  and damage to the system of automatic  rearm  Capability  Within the	, let	
S Vehicle Mis-alignment  Saximum resultant angle between  Nirtual  Supplies and ammunition  Be loaded or transferred at every  Combination  of terrain and resultant angle between the vehicles  within the specified limits without loss of system efficiency?  Can the FARV transload munitions and supplies at degree of terrain slope without damage to the system or loss of automatic rearm capability within the within the system or loss of supplies and supplies at degree of automatic rearm capability within the		
S Vehicle Mis-alignment  S Vehicle Mis-alignment  Davimum resultant angle between  S I combination  Of		
supplies and ammunition be loaded or transferred at every combination of terrain and resultant angle between the vehicles within the specified limits without loss of system efficiency?  Can the FARV transload munitions and supplies at degree of terrain slope without damage to the system or loss of automatic rearm capability within the within the system or loss of suthin the system or loss of automatic rearm capability within the	Responsiveness, Terrain Utilization	X(1)
### ##################################		
transferred at every combination of terrain and resultant angle between the vehicles within the specified limits without loss of system efficiency?  Can the FARV transload munitions and supplies at degree of terrain slope without damage to the system or loss of automatic rearm capability within the within the system or loss of automatic rearm	Terrain stope.	Event report PDU
Combination of terrain and resultant angle between the vehicles within the specified limits without loss of system efficiency?  Live Can the FARV transload munitions and supplies at degree of terrain slope without damage to the system or loss of automatic rearm capability within the	Resultant angle between vehicles.	Entity state PDU
resultant angle between the vehicles within the specified limits without loss of system efficiency?  Live Can the FARV transload munitions and supplies at degree of terrain slope without damage to the system or loss of automatic rearm capability	Time transfer began.	Event report PDU
angle between the vehicles within the specified limits without loss of system efficiency?  Live Can the FARV transload munitions and supplies at degree of terrain slope without damage to the system or loss of automatic rearm capability within the	Time transfer completed.	Event report PDU
Live Can the FARV transload munitions and supplies at degree of terrain slope without damage to the system or loss of automatic rearm capability within the		
specified limits without loss of system efficiency?  Live Can the FARV transload munitions and supplies at degree of terrain slope without damage to the system or loss of automatic rearm capability within the	Number of rounds transferred.	Resupply report PDU
Live Can the FARV transload munitions and supplies at degree of terrain slope without damage to the system or loss of automatic rearm capability within the	Amount of fuel and propellant transferred.	Resupply report PDU
Live Can the FARV transload munitions and supplies at degree of terrain slope without damage to the system or loss of automatic rearm capability within the	u w	
Live Can the FARV transload munitions and supplies at degree of terrain slope without damage to the system or loss of automatic rearm capability within the		
Q m	Terrain slope.	Event report PDU
Q sp	Resultant angle between vehicles.	Entity state PDU
	Time transfer began.	Event report PDU
	T.	
	Time transfer completed.	Event report r'DO
	Number of rounds transferred.	Resupply received PDU
capability within the	Amount of fuel and propellant transferred.	Resupply received PDU
values		
specified in the first		
column?		

X(1). Note: DIS Simulation could provide an appropriate environment for testing and evaluation, however data on the DIS network would not generally support the measurements needed.

### 2. Technical and Operational Benefits of Experimentation with Resupply Position Parameters.

2.1 Stated specifications. The FARV and AFAS will be able to transload projectiles, fuel and propellant from all trafficable slopes (40% lateral, 60% longitudinal) as long as the misalignment between vehicles is 10° or less. The on-board materials handling equipment must also be able to load, move, store, secure and unload projectiles, propellant and fuel without requiring the crew to get out of the crew cab on all trafficable slopes.

### 2.2 Other Aspects of Performance Measurable in a DIS Virtual Environment. N/A.

2.3 Sample Experiment. There are several types of experiments that can be accomplished either in software, in the DIS environment or a combination of the two. A single experiment/scenario in the DIS virtual environment can address each of the specifications of performance outlined above. Analysts and testers can run the same experiment repeatedly, incrementally altering parameters or designs to determine operational and technical tradeoffs offered by alternative crew station configurations, soldier-machine interfaces (SMIs), BCC designs, and autoloading designs/times.

stress on various autoloading components, designs and on overall mission capable rates and resupply time requirements may be determined. If there are adverse effects, then the emulation software can be modified so that there are no adverse effects and then be used to determine the impact of the restrictions on mission effectiveness in a DIS scenario. The overall impact of design changes can be measured in terms of the battle outcomes at the conclusion of the experiment/scenario. on the material handling system. For example, if the automatic materials handling emulation software has an interactive, selectable degree of slope feature, the impact of variable steep slopes. Emulating the ammunition transfer and handling system prototype will allow the investigation into the combined effects of different degrees of slope on the stresses Installation of a virtual ammunition transfer and handling system prototype in the AFAS and FARV simulator provides the opportunity to experiment with various SMIs, software design architectures, and component capabilities to determine the best fit to meet overall response time and rate of fire requirements. If the fidelity of the ammunition transfer ammunition when the AFAS and FARV are situated on terrain that have

# 3. Required Resources. To support experimentation and testing in the areas identified above the following resources are required:

- One AFAS crew to man an AFAS simulator
- One FARV crew to man an FARV simulator
- One AFAS simulator equipped with BCC, radios, modems, crew stations, crew displays, supporting software, with access to M712 Copperhead rounds in the ammunitiun
- One FARV simulator equipped with BCC, radios, modems, crew stations, crew displays, supporting software, with access to M712 Copperhead rounds in the ammunition
- One AFATDS POC computer to process the resupply requests during centralized AFAS operations, automatically relay resupply requests during decentralized uperations, and update AFAS information base on types and quantity of ammunition, fuel and propellant.
- One AFAS SAFOR to support senior to subordinate AFAS operations
- One FARV SAFOR to support senior to subordinate AFAS operations
- Threat SAFOR operations order
- Threat SAFOR to execute the order
- Friendly force operations order with fire support coordination measures and battlefield geometry
- Friendly SAFOR to execute the order

## 4. Emulators Required. The following models or emulations will be needed to support the AFAS and FARV simulators.

- 1. Primary ammunition handling and transfer mechanism for both vehicles.
- 2. Primary chassis and suspension emulation packages consisting of models representing springs/torsion bars, road wheels, tracks and track pads.

3. Chassis model (in software) consisting of chassis, turret, gun tube, crew cab, etc. Primary interest in the DIS testing is in the chassis-ammunition storage design and materials handling systems.

Subject of Experimentation/Testing: AFAS Ammunition Capacity

Specifications	Environments for Testing/ Experimentation	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Elements (X = Unsupportable by DIS PDUs)
Storage Capacity	Live or Virtual		Accuracy	
Automatically store 90 complete rounds.		Number of	Record of on-board projectile/fuze inventory by	Signal PDU
Automatically store propellant equal to 75 percent of maximum charge for the total of		stored	Record of physical count of ammunition uploaded by projectile and fuze combination	Event Report PDU
all rounds carried, including Coppernead.  Manually store two (2) M712 Copperhead projectiles.		Number of liters of LP stored	Number of liters of LP propellant loaded Record of quantity of LP system indicates is on- board the receiving vehicle	Signal PDU Event Report PDU
Store (TBD) number of rounds of secondary armament munitions		Number of rounds of secondary	Record of on-board secondary armament munition inventory by type Record of physical count of secondary armament munition inventory by type	Signal PDU Event Report PDU
		munitions stored		
Compatibility	Live		Compatibility	New entity type values need to be defined for
Automatically handle all current and developmental fuzed U.S. 155mm projectiles on exceeding 1 meter in length.			Record of incidents when ammunition was not compatibility Reason for incompatibility	several types of munitions not currently defined in DIS standards.
Projectiles - M107, M110, M110A1, M110A2, M116A1, M121A1, M449, M449A1, M485A1, M485A2, M892, M783A1, M483A2, M687, M692, M718, M718A1, M731, M741, M741A1, M795, M825A1, M549A1, M864, XM867, XM898, XM951, XM971 and XM982.				
Fuzes - M739 (PD), MK399 Mod 1, M762 (ET), XM767 (ET) and XM773 (MOFA)				
Manually handle Copperhead projectiles.				

battlefield. Assessment of the adequacy, maturity and compatibility of AFAS capabilities could be made. Selection and development of new or revised tactics, techniques and procedures could be pursued. Operation with the software of other FA systems and vehicles, including the FARV, demonstrates the system's ability to operate within the FA digital 2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment. A DIS Virtual Environment would allow evaluation of the tactics, techniques and procedures and key operational capabilities available to support and determine AFAS ammunition capacity and capabilities. The AFAS as a component of the "systems - the Field Artillery" must be able to transfer, store, load and fire a number of projectile and fuze combinations on the battlefield to effectively and efficiently complete its mission. The system could be looked at for integration of various levels of automation, expert (decision aids) systems and controls/displays and their impact on the operational effectiveness on the communications network.

#### 2.1 Stated specifications:

- Storage Capacity
  - Compatibility
- 2.2 Other Aspects of Performance Measurable in a DIS Virtual Environment. None
- generated to fire every projectile and fuze combination compatible with the AFAS system. Placing the AFAS simulator on a combined arms virtual battlefield may not permit validations of some aspects as specified in the AFAS specification. However, the overall impact of design capabilities can be measured in terms of the battle outcomes at the conclusion 2.3 Sample Experiment. A single experiment/scenario in the DIS virtual environment can address each of the specifications and other aspects of performance outlined above. Analysts and testers can run the same experiment repeatedly altering or invoking system capabilities. The experiments should be run against approved Training and Doctrine Command (TRADOC) scenarios appropriate to the AFAS System Threat Assessment Report (STAR) and at combat tempo in accordance with the approved Operational Mode Summary/Mission Profile (OMS/MP). For example if the scenario contains a number of fire missions with varied target descriptions and target sizes, sufficient fire missions could be of the experiment/scenario. Listed below are example battle statistics and conclusions that testers/analysts may derive from the data elements in the above matrix to correlate experiment results to design capabilities and/or changes:
- Median Times of Reload/Rearm/Resupply Operations
  - Average Rate of Reload/Rearm/Resupply Operations
- Accuracy of Reload/Rearm/Resupply Operations
  - Compatibility with Ammunition by type and size
    - Number of missions completed
- Number and type of Reload/Rearm/Resupply operations conducted
  - Number and types of projectile/fuze combinations resupplied
- Number and types of projectile/fuze combinations fired
- Number and type of resupply operations conducted without Decision Aids Number and type of resupply operations conducted with Decision Aids
  - Accuracy and quantity of messages by type related to resupply operations
    - Number and type of manual upload and unload operations conducted
- 3. Required Resources. To support experimentation and testing in the areas identified above the following resources are required:
- One AFAS crew to man an AFAS simulator
- One AFAS simulator equipped with BCC, radios, modems, crew stations, crew displays, supporting software One PARV SAFOR to support AFAS to FARV resupply/rearm/refuel, communications and docking operations
  - One SAFOR PLS Truck to support LRP Operations
- One SAFOR fuel truck to support LRP refueling operations
  - A Time Ordered Events List (TOEL)

Subject of Experimentation/Testing: FARV Ammunition Capacity

Specifications	Environments for Testing/	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Elements  (X = Unsupportable by DIS PDUs)
Storage Capacity	Live or Virtual		Accuracy	
Automatically store 130-200 complete rounds.		Number of rounds	Record of on-board projectile/fuze inventory by projectile and fuze combination  Record of physical count of amminition	Signal PDU Event Bennet PDN I
Automatical: tore propellant equal to 75 percent of maximum charge for the total of all rounds carried, including Copperhead.			uploaded by projectile and fuze combination	
Manually store two (2) M712 Copperhead projectiles.		Number of liters of LP stored	Number of liters of LP propellant loaded Record of quantity of LP system indicates is on- board the vehicle	Signal PDU Event Report PDU
Store (TBD) number of rounds of secondary		Number of	Record of on-board secondary armament	Signal PDU
		secondary armament munitions	Record of physical count of secondary armament   Event Report PDU munition inventory by type	Event Report PDU
Compatibility	Live		Compatibility	New entity type values need to be defined for
Automatically handle all current and developmental fuzed U.S. 155mm projectiles not exceeding 1 meter in length.			Record of incidents when ammunition was not compatibility Reason for incompatibility	several types of munitions not currently centred in DIS standards.
Projectiles - M107, M110, M110A1, M110A2, M116A1, M116A1, M449, M449A1, M485A1, M485A2, M804, M483A1, M483A2, M687, M692, M718, M718A1, M731, M741, M741A1, M795, M825A1, M549A1, M864, XM867, XM898, XM951, XM971 and XM982.				
Fuzes - M739 (PD), MK399 Mod 1, M762 (ET), XM767 (ET) and XM773 (MOFA)				-
Manually handle Copperhead projectiles.				-

crimentation/Testing: FARV Ammunition Capacity Subject c.

AFAS. The system could be looked at for integration of various levels of automation, expert (decision aids) systems and controls/displays and their impact on the operational effectiveness on the battlefield. Assessment of the adequacy, maturity and compatibility of FARV ammunition capabilities could be made. Selection and development of new or revised 2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment. A DIS Virtual Environment would allow evaluation of the tactics, techniques and procedures tactics, techniques and procedures could be pursued. Operation with the software of other PA systems and vehicles, including the AFAS, demonstrates the system's ability to operate Artillery" must be able to transfer, store and load a number of projectile and fuze combinations on the battlefield to effectively and efficiently complete its mission in support of the and key operational capabilities available to support and determine FARV ammunition capacity and capabilities. The FARV as a component of the "system of systems - the Fleid within the PA digital communications network.

#### 2.1 Stated specifications:

- Storage Capacity
  - Compatibility

# 2.2 Other Aspects of Performance Messurable in a DIS Virtual Environment. None

validations of some aspects as specified in the FARV specification. However, the overall impact of design capabilities can be measured in terms of the battle outcomes at the conclusion of the experiment/scenario. Listed below are example battle statistics and conclusions that testers/analysts may derive from the data elements in the above matrix to correlate Analysts and testers can run the same experiment repeatedly altering or invoking system capabilities. The experiments should be run against approved Training and Ductrine Command (TRADOC) scenarios appropriate to the FARV System Threat Assessment Report (STAR) and at combat tempo in accordance with the approved Operational Mode Summary/Mission Profile (OMS/MP). For example if the scenario contains a number of fire missions with varied target descriptions and target sizes, sufficient fire missions could be 2.3 Sample Experiment. A single experiment/scenario in the DIS virtual environment can address each of the specifications and other aspects of performance outlined above. generated to fire every projectile and fuze combination compatible with the FARV system. Placing the FARV simulator on a combined arms virtual battlefield may not permit experiment results to design capabilities and/or changes:

- Median Times of Reload/Rearm/Resupply Operations
- Average Rate of Reload/Rearm/Resupply Operations
  - Accuracy of Reload/Rearm/Resupply Operations
- Compatibility with Ammunition by type and size
- Number and type of Reload/Rearm/Resupply operations conducted Number of missions completed
  - Number and types of projectile/fuze combinations resupplied
    - Number and types of projectile/fuze combinations fired
- Number and type of resupply operations conducted with Decision Aids
- Number and type of resupply operations conducted without Decision Aids Accuracy and quantity of messages by type related to resupply operations
  - Number and type of manual upload and unload operations conducted
- 3. Required Resources. To support experimentation and testing in the areas identified above the following resources are required:
- One AFAS crew to man an AFAS simulator
- One AFAS simulator equipped with BCC, radios, modems, crew stations, crew displays, supporting software
   One FARV SAFOR to support AFAS to FARV resupply/rearm/refuel, communications and docking operations
  - One SAFOR PLS Truck to support LRP Operations
- One SAFOR fuel truck to support LRP refueling operations
  - A Time Ordered Events List (TOEL)

Subject of Experimentation/Testing: AFAS Docking

Specifications	Environments for	Measures of	Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs Required to
•	Testing/	Performance	Collection if DIS Virtual Simulation is	Collect Data Elements
	Experimentation		Appropriate Environment	(X = Uneupportable by DIS PDUs)
Docking Time - Favorable Terrain. The	Live or Virtual		Time	
AFAS shall be capable to receive and store 60				
complete rounds of primary armament		Median	Time Docking completed	Event Report PDU
munitions (except Copperhead) in less than		Docking	Time Docking initiated (when AFAS and FARV	Event Report PDU
12 minutes (time includes docking, transfer		Time	are within 8 m (26.25 ft) and respective resupply	
cargo, and undock on slopes (any direction)			ports are facing each other)	
of less than 10 degrees resultant angle between vehicles).			Resultant angle (in degrees) between vehicles	Event Report PDU
		Median	Time receiver system acknowledges control of	Signal PDU
	•	Time of	resupply operation	
		Resupply	Time of undocking	Event Report PDU
		Operation		
		Total Time	Time of undocking	Event Report PDU
		of Resupply	Time Docking initiated (when AFAS and FARV	Event Report PDU
		Operation	are within 8 m (26.25 ft) and respective resupply	•
			ports are facing each other)	
			Accuracy	
		Accuracy of	Number of complete rounds resupplied by lot.	Event Report PDU
		resupply	projectile with fuze, quantity and weight (Receiver	•
		data	system)	
		exchange	Number of complete rounds resupplied by lot, projectile with first quantity and weight (Sender	Event Report PDU
			system)	

Subject of Experimentation/Testing: AFAS Docking

Specifications	Environments for Testing/	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is	Existing, Modified, or New DIS PDUs Required to
+	Live or Virtual		Time	food for Agranged more
the vehicles (AFAS and FARV or FARV and another FARV) are within 8 meters of each other, and respective rearm ports are facing each other, The Rearm/Resupply Subsystem		Median Docking Time	Time Docking completed Time Docking initiated (when AFAS and FARV are within 8 m (26.25 ft) and respective resupply	Event Report PDU Event Report PDU
shall be able to dock and connect in [TBD] minutes under adverse conditions (slopes,			ports are facing each other) Resultant angle (in degrees) between vehicles	Event Report PDU
any discussion up to 10 degrees resultain angle between vehicles.)		Median	Time receiver system acknowledges control of	Signal PDU
		Resupply Operation	resupply operation  Time of undocking	Event Report PDU
		Total Time of Resupply Operation	Time of undocking Time Docking initiated (when AFAS and FARV are within 8 m (26.25 ft) and respective resupply ports are facing each other)	Event Report PDU Event Report PDU
			Accuracy	
		Accuracy of resupply	Number of complete rounds resupplied by lot, projectile with fuze, quantity and weight (Receiver	Event Report PDU
		exchange	of security with fuze, quantity and weight (Sender system)	Event Report PDU
Docking Under Cover. The Rearm/Resupply Subsystem shall not	Live or Virtual		Capability	
require personnel outside either vehicle during docking operations.			Record of resupply operations conducted with crew members outside of the vehicle during docting onesations	×
			Reason for crew member being required to be outside the vehicle	×
Rapid Disconnect. The Rearm/Resupply Subsystem shall be able to perform a rapid	Live or Virtual	Median Rapid	Time	
disconnect (less than 10 seconds) with no		Disconnect	Time rapid disconnect initiated	××
AFAS and no loss of projectiles.			Record of projectile loss Record of damaged components Reson for rapid disconnect	(×××
Disconnect without Spillage of Fuel. Rapid	Live or Virtual	Average Amount of	Quantity	
result in more than [TBD] liters of fuel			Record of quantity of fuel spillage that resulted	×
spillage.		Spillage from Rapid	from rapid disconnect operations Reason for rapid disconnect	×
		Operations		

B - 145

Subject of Experimentation/Teeting: AFAS Docking

Specifications	Environments for Testing	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is	Existing, Modified, or New DIS PDUs Required to Collect Data Elements
Interface. The AFAS shall have a physical	Live or Virtual		Coability	(SOCIETY OF STREET
interface with the FARV. The interface shall			•	
include a power interface, an ammunition			Record of fuel transfers completed through	Signal PDU
transfer interface, a fuel transfer interface,			docking interface	3
and a communications interface. With the			Record of voice and digital communications	Signal PDU
exception of the power interface, these			conducted through the docking interface	
interfaces shall be achieved via the docking			Record of ammunition transfers conducted	Signal PDU
of the system with the FARV.			through the docking interface	
Disconnect Without Spillage of Propellant.	Live or Virtual	Average	Quantity	
Rapid disconnect from the other vehicle		Amount of		
shall not result in more than [TBD] liters of		Fuel	Record of quantity of LP propellant spillage that	×
liquid propellant spillage.		Spillage	resulted from rapid disconnect operations	
		from Rapid	Reason for rapid disconnect	Event Report PDU
		Disconnect	•	•
		Operations		
Communications Link. When the FARV	Live or Virtual		Capability	
and AFAS, or FARV and another FARV, are				
dicked together a voice and data			Record of digital communications between	Signal PDU
communications connection must be			vehicles when docked	1
automatically established.			Record of voice communications between	Signal PDU
			vehicles when docked	•
Fuel Transfer. The AFAS shall be capable of	Live or Virtual		Time	
remotely and simultaneously transferring		;	i	
fuel from its own fuel cell into the FAKV at		Median Fuel	Time fuel transfer stopped	Event Report PDU
a rate of at least 132 liters per minute.		Transfer Time	Time fuel transfer started	Event Report PDU
			Rate	
		Median Fuel	Ouantity (in liters) of fuel transferred	Event Report PDU
		Transfer	Total time required for fuel transfer	Event Report PDU
		Rate		

## Subject of Experimentation/Testing: AFAS Docking

workload task analysis. The system could be looked at for integration of automation, expert (decision aids) systems and controls/displays. Assessment of the adequacy, maturity and related to automated resupply of ammunition, propellant and fuel. It would also permit evaluation of reduced rearm time, increased payload capability of 60 rounds, crew size and 2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment. A DIS Virtual Environment would allow demonstration of key technologies in docking Demonstrate the achievability of the new technologies being applied to the AFAS (automation, advanced propellant handling, ammunition management, and automated compatibility of ammunition transfer operations. Evaluate potential for integration into a combat support system. Evaluate selection and development of technologies. ammunition transfer and docking)

#### 2.1 Stated specifications:

- Docking Time Favorable Terrain
- Docking Time Unfavorable Terrain

  - Docking Under Cover Rapid Disconnect
- Disconnect without Spillage of Fuel
- Disconnect without Spillage of Propellant
  - Physical Interface
- Communications Link
  - Fuel Transfer

# Other Aspects of Performance Measurable in a DIS Virtual Environment.

- Overall effectiveness of docking operations between AFAS and FARV
- Overall effectiveness of resupply operations supporting combat operations at battlefield tempo.
- selectable interfaces for fuel, propellant, communications and ammunition), the impact of various docking and interface designs on docking time and requirements may be determined. Placing 2.3 Sample Experiment. A single experiment/scenario in the DIS virtual environment can address each of the specifications and otner aspects on periodications, soldier-machine interfaces and testers can run the same experiment repeatedly altering designs to determine operational and technical transfer rate, propellant transfer rate, different docking mechanisms, different and testers can run the same experiment repeatedly altering designs to determined. Placing (SMIs), and varied terrain. For example, if AFAS simulator software has a selectable docking and interface designs on docking time and requirements may be determined. Placing time and requirements and ammunition), the impact of various docking and interface designs on docking time and requirements. However, the overall impact of various docking and interface designs on docking time and requirements may be determined. design changes can be measured in terms of the battle outcomes at the conclusion of the experiment/scenario. Listed below are example battle statistics that testers/analysts may derive from the data elements in the above matrix to correlate experiment results to design changes:
- Median docking times
- Number of dockings completed
  - Median resupply times
- Number of resupply operations conducted
  - Accuracy of resupply data exchanges
    - Number of rapid disconnects
- Number of liters of fuel spilled during rapid disconnect operations Median time required to conduct rapid disconnect operations
  - Fuel usage rates for the battle
    - Number of missions fired
- Number of projectiles fired by type
- Number of missions not fired due to ammunition shortages
- Number of missions not fired due to LP propellant shortages
  - Number of missions not fired due to fuel shortages
    - Fuel transfer rates during combat operations
- Ammunition transfer rates during combat operations

## Subject of Experimentation/Testing: AFAS Docking

- One AFAS crew to man an AFAS simulator
  One AFAS crew to man an FARV simulator
  One AFAS simulator equipped with radios, modems, crew stations, crew displays, supporting software
  One AFAS simulator equipped with radios, modems, crew stations, crew displays, supporting software
  One FARV simulator equipped with radios, modems, crew stations, crew displays, supporting software
  One AFAT DE POC computer to persion operation force targets on the virtual battlefield information.
  One AFATDS POC computer to process the observer's call for fire during centralized AFAS operations and battlefield information.
  One AFATDS POC computer to process the observer's call for fire during centralized AFAS operations and battlefield geometry
  FARV information base on LRP locations, resupport coordination measures and battlefield geometry
  Friendly force operations order with fire support coordination measures and battlefield geometry
  Friendly SAFOR to execute the order

Subject of Experimentation/Testing: FARV Docking

Specifications	Environments for Testing/ Experimentation	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Elements (X = Unsupportable by DIS PDUs)
PARV shall be capable of transferring 60	Live or Virtual		Time	
complete rounds of primary armament		Median	Time Docking completed	Event Report PDU
munitions (except Copperhead) to the AFAS in less than 12 minutes (time		Docking Time	Time Docking initiated (when AFAS and FARV are within 8 m (26.25 ft) and respective resupply	Event Report PDU
includes docking, transfer cargo, and			ports are facing each other)	
undock on slopes (any direction) of less than 10 degrees resultant angle between			Resultant angle (in degrees) between vehicles	Event Report PDU
vehicles).		Median	Time receiver system acknowledges control of	Signal PDU
		Resupply Operation	resupply operation  Time of undocking	Event Report PDU
		Total Time of Resupply	Time of undocking Time Docking initiated (when AFAS and FARV	Event Report PDU Event Report PDU
		Operation	are within 8 m (26.25 ft) and respective resupply ports are facing each other)	,
			Accuracy	
		Accuracy of resupply	Number of complete rounds resupplied by lot, projectile with fuze, quantity and weight (Receiver	Event Report PDU
		data exchange	syster.) Num∴er of complete rounds resupplied by lot, projectile with fuze, quantity and weight (Sender	Event Report PDU
			system)	

Subject of Experimentation/Testing: FARV Docking

Specifications	Environments for Testing/	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is	Existing, Modified, or New DIS PDUs Required to
	Experimentation		Appropriate Environment	(X = Unsupportable by DIS PDUs)
Docking Time - Unfavorable Terrain. Once the vehicles (APAS and PARV or	Live or Virtual		Time	
FARV and another FARV) are within 8		Median	Time Docking completed	Event Report PDU
rearm ports are facing each other, The		Time	are within 8 m (26.25 ft) and respective resupply	Event Report PDO
Rearm/Resupply Subsystem shall be able to dock and connect in [TBD] minutes			ports are facing each other) Resultant angle (in degrees) between vehicles	Event Report PDU
under adverse conditions (slopes, any direction up to 10 degrees resultant angle		Median	Time receiver system acknowledges control of	Signal PDU
between vehicles.)		Time of	resupply operation	
		Resupply Operation	Time of undocking	Event Report PDU
		Total Time	Time of undocking	Event Report PDU
		of Resupply	Time Docking initiated (when AFAS and FARV	Event Report PDU
		ione isolo	ports are facing each other)	
			Accuracy	
		Accuracy of	Number of complete rounds resupplied by lot,	Event Report PDU
		data	projective with 1926, quantity and weight (Acceiver system)	
		exchange	Number of complete rounds resupplied by lot,	Event Report PDU
			system)	
Docking Under Cover. The	Live or Virtual		Capability	
Rearm/Resupply Subsystem shall not			Record of resumply operations conducted with	<b>&gt;</b>
during docking operations.			crew members outside of the vehicle during	<
			docking operations	
			Reason for crew member being required to be outside the vehicle	×
had	Live or Virtual	Median	Time	
subsystem shall be able to perform a		Kapid	Time ranid disconnect initiated	<b>*</b>
with no damage to components of the		Time	Time rapid disconnect initiated	<×
FARV or AFAS and no loss of			Record of projectife loss	×
projectnes.			Reason for rapid disconnect	<×
Disconnect without Spillage of Fuel.	Live or Virtual	Average	Quantity	
shall not result in more than [TBD] liters		Fuel	Record of quantity of fuel spillage that resulted	×
of fuel spillage.		Spillage	from rapid disconnect operations	,
		Disconnect	Neason for rapid disconnect	
		Operations		

Subject of Experimentation/Testing: FARV Docking

Specifications	Environments for Testing/ Experimentation	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Elements (X = Unsupportable by DIS PDUs)
Disconnect Without Spillage of	Live or Virtual	Average	Quantity	
other vehicle shall not result in more		Fuel	Record of quantity of LP propellant spillage that	*
than ITBDI liters of liquid propellant		Spillage	resulted from rapid disconnect operations	:
spillage.		from Rapid Disconnect	Reason for rapid disconnect	Event Report PDU
		Operations		
Physical Interface. The FARV shall have Live or Virtual	Live or Virtual		Capability	
a physical interface with APASs and				
other FARVs. The interface shall			Record of fuel transfers completed through	Signal PDU
include a power interface, an		-	docking interface	
ammunition transfer interface, a fuel			Record of voice and digital communications	Signal PDU
transfer interface, and a communications			conducted through the docking interface	
interface. With the exception of the			Record of ammunition transfers conducted	Signal PDU
power interface, these interfaces shall be			through the docking interface	•
achieved via the docking of the system			,	
with the AFAS or FARV.				
Communications Link. When the	Live or Virtual		Capability	
FARV and AFAS, or FARV and another				
FARV, are docked together a voice and			Record of digital communications between	Signal PDU
data communications connection must			vehicles when docked	
be automatically established.			Record of voice communications between	Signal PDU
			vehicles when docked	
Fuel Transfer. The AFAS shall be	Live or Virtual		Time	
capable of remotely and simultaneously				
transferring fuel from its own fuel cell		Median Fuel	Time fuel transfer stopped	Event Report PDU
into the FARV at a rate of at least 132		Transfer	Time fuel transfer started	Event Report PDU
liters per minute.		Time		•
			Rate	
		Median Fuel	Quantity (in liters) of fuel transferred	Event Report PDU
		Transfer Rate	Total time required for fuel transfer	Event Report PDU
		2101		

## Subject of Experimentation/Testing: FARV Docking

rounds, crew size and workload task analysis. The system could be looked at for integration of automation, expert (decision aids) systems and controls/displays. Assessment of the adequacy, maturity and compatibility of ammunition transfer operations. Evaluate potential for integration into a combat support system. Evaluate selection and development of 2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment. A DIS Virtual Environment would allow demonstration of key technologies in docking related to automated resupply of ammunition, propellant and fuel. It would also permit evaluation of reduced rearm time, increased payload capability of between 130 and 200 technologies. Demonstrate the achievability of the new technologies being applied to the AFAS (automation, advanced propellant handling, ammunition management, and automated ammunition transfer and docking).

#### 2.1 Stated specifications:

- Docking Time Pavorable Terrain
- Docking Time Unfavorable Terrain
  - Docking Under Cover
    - Rapid Disconnect
- Disconnect without Spillage of Fuel
- Disconnect without Spillage of Propellant
  - Physical Interface
- Communications Link
  - Fuel Transfer

# 2.2 : Other Aspects of Performance Measurable in a DIS Virtual Environment.

- Overall effectiveness of docking operations between AFAS and FARV
- Overall effectiveness of resupply operations supporting combat operations at battlefield tempo.
- Sample Experiment. A single experiment/scenario in the DIS virtual environment can address each of the specifications and other aspecte or processing the specifications and other aspecte or processing designs to determine operational and technical tradeoffs offered by different docking mechanisms, different and testers can run the same experiment repeatedly altering designs to determine operational and testers can run the same experiment software has a selectable docking capabilities (fuel transfer rate, propellant transfer rate, different docking mechanisms, different and testers can run the same experiments may be determined. Placing (SMIs), and varied terrain. For example, if FARV simulator software has a selectable docking and interface designs on docking time and requirements may be determined. (SMIs), and varied terrain. However, the overall impact of various accuracy to the degree specified in the FARV specification. However, the overall impact of various and ammunition. design changes can be measured in terms of the battle outcomes at the conclusion of the experiment/scenario. Listed below are example battle statistics that testers/analysts may derive from the data elements in the above matrix to correlate experiment results to design changes:
- Median docking times
- Number of dockings completed
  - Median resupply times
- Number of resupply operations conducted
  - Accuracy of resupply data exchanges
    - Number of rapid disconnects
- Median time required to conduct rapid disconnect operations
- Number of liters of fuel spilled during rapid disconnect operations
  - Fuel usage rates for the battle
    - Number of missions fired
- Number of projectiles fired by type
- Number of missions not fired due to ammunition shortages
- Number of missions not fired due to LP propellant shortages
  - Number of missions not fired due to fuel shortages
    - Fuel transfer rates during combat operations
- Ammunition transfer rates during combat operations
- 3. Required Resources. To support experimentation and testing in the areas identified above the following resources are required:

## Subject of Experimentation/Testing: FARV Docking

- One AFAS crew to man an AFAS simulator
- One FARV crew to man an FARV simulator

- One AFAS simulator equipped with radios, modems, crew stations, crew displays, supporting software
  One FARV simulator equipped with radios, modems, crew stations, crew displays, supporting software
  One observer to acquire and submit calls for fire to engage opposition force targets on the virtual battlefield.
  One observer to acquire and submit calls for fire to engage opposition force targets on the virtual battlefield.
  One AFATDS POC computer operator
  One AFATDS POC computer to process the observer's call for fire during centralized AFAS operations.
  One AFAS and FARV SAFOR to support senior to subordinate AFAS operations
  Friendly force operations order with fire support coordination measures and battlefield geometry
  Friendly SAFOR to execute the order

Subject of Experimentation/Testing: AFAS Ammunition Transfer Operations

Specifications	Environments for	Measures of	Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs Required to
	Testing/ Experimentation	Performance	Collection if DIS Virtual Simulation is Appropriate Environment	Collect Data Elements (X = Unsupportable by DIS PDUs)
Upload Rate (PLS to AFAS).	Live or Virtual		Time	A combination of the Service Request PDU,
When the FARV is unavailable, the AFAS shall be capable of supporting a crew performed manual upload of fuzed projectiles and propellant from combat		Median Time of Upload	Time upload finished Time upload started Number of rounds loaded Number of liters LP propellant loaded	Resupply Cancel PDU and Event Report PDU can accommodate the data elements for this function.
configured loads on PLS flatracks at an average rate of one complete round per minute. The upload (rearm) function includes required processing of fuzes and projectiles plus data entry including type of			Type of upload (Fully Automated, Semi-Automated or Manual) Number of crew members Rate	
projective, type or tuze, for number of fuze, for number of propellant, for number of projectile weight.		Average Upload Rate	Total time required to conduct upload Number of rounds loaded Number of liters LP propellant loaded Type of upload (Fully Automated, Semi-Automated or Manual) Number of crew members	
			Accuracy	
		Accuracy of Upload	Actual round count by projectile fuze combination, and fuze and projectile lot System round count by projectile fuze combination, and fuze and projectile lot	
Download (AFAS to FARV).	Live or Virtual		Tine	A combination of the Service Request PDU, Beaunaly Offer PDM Beaunaly Beautage PDM
The AFAS shall be capable of automatically downloading 60 complete rounds (fuzed projectiles and LP propellant) to a CCL flatrack or the ground (LP to containers) in less than 20 minutes.		Median Download Time	Time when the FARV is again capable of maneuver (Stop Time) Time when the system initiates a maneuver to conduct docking (Start Time) Number of rounds loaded Number of itses I P propalan loaded	Resupply Cancel PDU and Byent Report PDU can accommodate the data elements for this function.
The AFAS crew must be able to manually transfer 2 Copperhead to the FARV within the time standard established for automated download.			Time stopped transfer of 2 Copperheads Time started transfer of 2 Copperheads Rate	
The AFAS must allow the crew to manually unload 60 complete rounds (fuzed projectiles and LP propellant) to a CCL flatrack or the ground (LP to containers) in less than 45 minutes.		Average Download Rate	Total time required to conduct download/unload Number of rounds downloaded/unloaded Number of liters LP propellant downloaded/unloaded Type of download (Automated or Manual)	
			Accuracy	
		Accuracy of Download	Actual round count by projectile fuze combination, and fuze and projectile lot System round count by projectile fuze combination, and fuze and projectile for	

Subject of Experimentation/Testing: AFAS Ammunition Transfer Operations

Specifications	Environments for Measures of Testing/ Performance	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Elements  (X = Unsupportable by DIS PDUs)
Exchange (AFAS to FARV).	Live or Virtual		Time	A combination of the Service Request PDU,  Recursoly Offer PDI Beauty Brosser PDI
The AFAS shall be capable of receiving ammunition from the FARV at a rate of not less than 3 complete processed rounds of primary armament munitions (except Copperhead) per minute.  The exchange of 60 complete processed rounds of primary armament shall take no longer than 20 minutes.		Median Bxchange Time	Time last round crosses the resupply port (Stop Time)  Time the first round is passed through the resupply port (Stop Time)  Number of rounds unloaded  Number of liters LP propellant unloaded  Type of unload (Fully Automated, Semi-Automated or Manual)  Number of crew members	Resupply Cancel PDC, and Byent Report PDU can accommodate the data elements for this function.
			Rate	
		Average Exchange Rate	Total time required to conduct unload Number of rounds unloaded Number of liters LP propellant unloaded Type of unlosé (Fully Automated, Semi- Automated or Manual) Number of crew members	
			Accuracy	
		Accuracy of Unioad	Actual round count by projectile fuze combination, and fuze and projectile lot System round count by projectile fuze combination, and fuze and projectile lot	
Upload Rate (FARV to AFAS).	Live or Virtual		Time	A combination of the Service Request PDU, Recurred Offer PTVI Beauty Bactions PTVI
The Primary Armament Subsystem shall be able to receive and store 60 complete rounds of primary armament munitions (except Copperhead) in less than 12 minutes (time includes docking, transfer cargo, and undock on slopes (any direction) of less than 10 degrees resultant angle between vehicles).		Median Resupply Time	Time when the FARV is again capable of maneuver (Stop Time)  Time when the system initiates a maneuver to conduct docking (Start Time)  Number of rounds resupplied  Number of liters LP propellant loaded  Time stopped transfer of 2 Copperheads  Time stander transfer of 2 Comenheads	Resupply Cancel PDU and Bvent Report PDU can accommodate the data elements for this function.
The FARV crew must be able to manually transfer 2 Copperhead to the AFAS within			Rate	
resupply.		Average Resupply Rate	Total time required to conduct resupply Number of rounds resupplied Number of liters LP propellant resupplied Type of resupply (Automated or Manual)	
			Accuracy	
		Accuracy of Download	Actual round count by projectile fuze combination, and fuze and projectile lot System round count by projectile fuze combination, and fuze and projectile tot	

Subject of Experimentation/Testing: AFAS Ammunition Transfer Operations

	Toolloo,	Performance	Collection of Dis Views Standard to	
	Experimentation		Appropriate Environment	(X = Uneupportable by DIS PDUs)
Compatibility (Ammunition). The AFAS must be capable of automatically handling all current and developmental (those fielded or in EMD before the start of AFAS EMD) (used 11S. 155mm projectiles	Live		Compatibility  Record of incidents when ammunition was not compatibility  Reason for incompatibility	New entity type values need to be defined for several types of munitions not currently defined in DIS standards.
not exceeding 1 meter in length. Projectiles - M107, M110, M110A1, M110A2, M116A1, M121A1, M449, M449A1, M485A1, M485A2, M80A, M483A1, M483A2, M687, M692, M718, M718A1, M731, M741, M741A1,				
M795, M825.A1, M549.A1, M864, XM867, XM898, XM951, XM971 and XM982. Fuzes - M739 (PD), MK399 Mod 1, M762 (ET), XM767 (ET) and XM773 (MOFA)				
M712 Copperhead may be loaded and transferred to AFAS manually.				
Compatibility (Ammunition Systems). The	Live or Virtual		Compatibility	Not Applicable
packaging systems and automated loading			Type of automated loading system used (AIRRS, FAAPS, etc.)	
systems (those helded of in EMD and before the start of AFAS EMD).			Type of munitions packaging system used (17.2) Hatrack, pallets, etc.) Type of loading operation conducted Animaled Sami-Animaled or Manual)	
Decision Aid Capability. The AFAS must	Live or Virtual		Capability	
assist the crew in making factical decisions associated with conducting and management			Number of resupply and support operations conducted with Decision Aids	Event Report PDU
and conduct of support operations.			Number of resupply and support operations conducted without Decision Aids Crew comments on operations conducted with	Event Report PDU X
Interoperability.	Live or Virtual		and without Decision Aids Completenese	
The AFAS system shall be compatible with		Percent of	Number of messages received by the ARAS	Gonal PD1:
Field Artillery Tactical Data System			P	Signal POU
The AFAS exciem at least through the		translated	Number of messages not acknowledged (NAK)	Signal PDU
Dem/Val phase, shall be fully compatible and interactive with TACFIRE Version 10.		error		
FSS-15-1171.		Percent of outgoing	Number of messages sent by the system Number of messages properly acknowledged	Signal PDU Signal PDU
The AFAS must interface with the C31 architecture of FARV.		messages translated without	(ACK) by the receiver  Number of messages not acknowledged (NAK) by the receiver	Signal PDU
		error		

Subject of Experimentation/Testing: AFAS Ammunition Transfer Operations

To ARAS must provide intervehicular tooke communications and digital transfer of data with the FARV when connected for resupply/download operations.  The POC or senior howitzer if in a subordinate role shall be automatically informed of the current on-board ammunition inventory after each mission, after completion of ammunition resupply, and after ammunition download.	Experimentation Live or Virtual Correct digital transfers of data during resupply operations	<u> </u>	Collection if DIS Virtual Simulation is Appropriate Environment Completeness	Collect Data Elements (X = Unsupportable by DIS PDUs)
ir of y,	Virtual	<u> </u>	Apleteness	
e AFAS must provide intervenciust fee communications and digital transfer of a with the FARV when connected for upply/download operations.  Por or senior howitzer if in a bordinate role shall be automatically formed of the current on-board naunition inventory after each mission, fer completion of ammunition resupply, defer ammunition download.	recent correct digital transfer data du resuppl operati	_		
upply/download operations.  upply/download operations.  POC or senior howitzer if in a bordinate role shall be automatically formed of the current on-board naunition inventory after each mission, fer completion of ammunition resupply, d after ammunition download.	digital transfer data du resuppi operati		impos of subcomptod successful contractions	TOO town a town
upply/download operations.  Poc or senior howitzer if in a bordinate role shall be automatically formed of the current on-board munition inventory after each mission, fer completion of ammunition resupply, d after ammunition download.	transfer data du resuppi operati	- atte	attempted	
bordinate role shall be automatically bordinate role shall be automatically formed of the current on-board naunition inventory after each mission, fer completion of ammunition resupply, d after ammunition download.	data du resuppi operati	<u> </u>	Number of automated resupply operations	Event Report PDU
be PCK or senior howitzer if in a bordinate role shall be automatically formed of the current on-board naunition inventory after each mission, for completion of ammunition resupply, dafter ammunition download.	resupp	<u> </u>		
formed of the current on-board naunition inventory after each mission, for completion of ammunition resupply, d after ammunition download.			Records of digital transfer of data  Decord of intervehicular voice communications	Signal PDU
nmunition inventory after each mission, for completion of ammunition resupply, d after ammunition download.	-			
ter completion of ammunition resupply, d after ammunition download.				
d after ammunition download.		<u> </u>		
		Yes	Accuracy	
The AFAS shall automatically transmit a	Percent of		Number of on-board ammunition status changes	
message to the POC whenever there is a	inventory		Type of operation (rearm, upload, download,	
change in system status that affects mission	status	_	transload, correction, etc.)	
supplies inventories.			messages sent	
When the AFAS is docked with a FARV,		S	Compatibility	
voice/data communications shall be				
established and automatically initiated as a	Percent of		Number of dockings	Event Report PDU
part of the mating of two vehicles in	Successful		Number of data exchanges conducted to initiate	Signal PDU
provide for the transfer of all control data	docking		בייוים וווכירונייונג טו הפום הכוחכנו שלאכוווש	
required to coordinate the transfer processes.	links		Capability	
When uploading ammunition and fuel	Percent of	_	Number of data exchanges initiated between	
from the FARV, the AFAS shall	njeseone	80.	systems	Signal PDU
send/receive data to/from the FARV over	data		Number of data exchanges conducted between	
the communications link during docking.	exchanges		systems	Signal PDU
		Acc	Accuracy	
The on-board ammunition inventory shall	Percent of		Number of ammunition inventory updates	Event Report PDU
be automatically updated after each round is	successful		Number of instances where inventory required	Bvent Report PDU
fired, after receipt of ammunition (upload,	ammunitio	3	ate	
download, rearm, or other supply transaction) which requires changes to on-	satenda u		Neason for update (rearm, upload, download, transload, correction, etc.)	Event Report 1700
board inventory information.				-
•		V CC	Acuracy	
When conducting resupply operations	Accuracy of	ठ	Number of fuzed projectiles by lot, fuze, type and Signal PDU	Signal PDU
(Manual and With FARY), the ArAS shall transmit (when downloading) or receive	resuppiy	<u> </u>	Weignt transferred by sending system Number of firzed numberfiles by lot, firze, type and	Event Benort PDi
(When uploading) the following	exchange		th accepted by receiving system	_
information, as applicable: LP lot number (if			Number of LP libers transferred by sending	Signal PDU
required) and quantity, quantity of fuer, projectile model, projectile to number.	<del></del>	System	Stem Number of I.P liters accepted by receiving system	Event Report PDI
fuzed weight, fuze model and fuze lot.	_	<u> </u>	Type of operation (rearm, upload, download,	Signal PDU

Subject of Experimentation/Testing: AFAS Ammunition Transfer Operations

Specifications	Environments for Messures of Testing/ Performance Experimentation	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Elements  (X = Unsupportable by DIS PDUs)
Data Entry.	Live or Virtual		Accuracy	
During resupply of previously coded projectiles, the AFAS shall verify the projectile coding (projectile's type, lot, fuze and fuzed weight) matches the data specified on the inventory received during resupply.		Percent of correct projectile coding events	Number of attempts to read projectile data Number of projectiles and data accepted by the system Accuracy	Event Report PDU Bvent Report PDU
		Accuracy of reading projectile data	Record of data read by the projectile coding system by type of projectile, type of fuze, lot number of fuze, lot number of propellant, lot number of projectile, and fuzed projectile weight Record of actual projectile data by type of projectile, type of fuze, lot number of fuze, lot number of projectile, and fuzed projectile, weight.	Event Report PDU  Event Report PDU
The AFAS crew must be able to manually enter data into the AFAS system including type of projectile, type of fuze, lot number of fuze, lot number of projectile, and fuzed projectile weight.		Accuracy of manual entry of projectile data	Accuracy  Record of data entered by operator by type of projectile, type of fuze, lot number of fuze, lot number of projectile, and fuzed projectile weight Record of actual projectile data by type of projectile, type of fuze, lot number of fuze, lot	Event Report PDU  Event Report PDU
			number of propellant, lot number of projectile, and fuzed projectile weight. Record of observed operator input errors	Event Report PDU
Selectability.	Live or Virtual		Accuracy	
Fuzed projectiles and liquid propellant stored within the AFAS shall be automatically accessible by the system.		Percent of requests satisfied	Record of data requested by receiving system Record of data provided by sending system Record of automated ammunition selection requests by quantity of propellant, type of	Signal PDU Signal PDU Signal PDU
The AFAS must provide for automated ammunition selection, transfer, cataloging and inventory of fuzed projectiles, fuel and propellant.			projectile, type of fuze, lot number of fuze, lot number of propellant, lot number of projectile, and fuzed projectile weight Record of requested quantities furnished by quantity of propellant, type of projectile, type of fuze, lot number of fuze, lot number of projectile of number of projectile.	Signal PDU

Subject of Experimentation/Testing: AFAS Ammunition Transfer Operations

Specifications	Environments for Measures of Testing/ Performance Experimentation	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Elements  (X = Unsupportable by DIS PDUs)
Storage.	Live or Virtual		Capability	
The AFAS shall store, within the integral structure of the vehicle, at least 60 complete processed rounds of primary armament munitions. The Copperhead propellant will be stored with the propellant from the other 130 complete processed rounds.  Stowed primary armament ammunition shall be accessible by the crew without having to evit the vehicle.			Number of complete processed rounds stored Number of Copperhead rounds stored Storage location for Copperhead propellant and rounds Quantity of LP and Copperhead propellant stored Record of data system inventory by quantity of propellant, type of projectile, type of fuze, lot number of fuze, lot number of propellant, lot number of projectile, and fuzed propellant, lot	Event Report PDU  Event Report PDU  Event Report PDU  Event Report PDU
Control. During transfer of munitions or fuel, the C3 Subsystem shall permit the	Live or Virtual	Percent of	Accuracy	
system receiving ammunition, LP and fuel		resupply	Number of instances where receiver (controller)	Signal PDU
to control the resupply process (request		commands	issued commands	
ammunition orders, issue			Number of instances where sender (controller)	Signal PDU
stop/go/disconnect commands, etc.). Inis			property actioned the requested command  Then of insteading issued (request amountition)	
process can be interrupted in an emergency.			Type of instruction issued (request ammunition orders, issue stop/go/disconnect commands, etc.)	
			Number of emergency interruptions	Signal PDU
			Reason for emergency interruption	Signal PDO
Docking under cover. The AFAS shall be able to dock with a FARV without requiring	Live or Virtual .		Capability	
the crew to leave the crew compartment.			Record of dockings with crew out of	Event Report PDU
			compartment Record of dockings with crew in compartment	Event Report PDU
Power. The AFAS must be able to accept	Live or Virtual		Capability	
sufficient power from an external source to				
enable the AFAS to download ammunition,			Record of instances where external power was	Event Report PDU
run diagnostic routine or start the engine.			required Record of instances were external nower was	Event Report PDII
			applied and successful	
Repid Disconnect. The AFAS shall be able to underk from a FARV within 10 seconds	Live or Virtual		lime	
with no damage to components, no loss of		Median	Time rapid disconnect action completed	Event Report PDU
projectiles, and minimal spillage of fuel and		rapid	Time rapid disconnect action initiated	Event Report PDU
liquid propellant.		disconnect	Record of damage to components	Event Report PDU
		ě	Record of 10st projectives Record of LP splittings	Event Report PDU
			Record of tuel spininge	Event Report I'DU

## Subject of Experimentation/Testing: AFAS Ammunition Transfer Operations

ammunition, propellant and fuel. It would also permit evaluation of reduced rearm time, payload capability (60 rounds), crew size and workload task analysis. The system could be looked at for levels support system in terms of resupply priorities, requisitions, configurations of CCL loads, types and quantities of ammunition requested, fired and returned. A DIS experimental approach would permit evaluation and development of selected technologies. DIS experiments could demonstrate the suitability of the new technologies being applied to the AFAS covering automation, advanced propellant and integration of automation, expert (decision aids) systems and controls/displays. The assessment of the adequacy, maturity and compatibility of ammunition transfer operations could be made based on results of the experiments. Several iterations of simulated battle covering 48 to 96 hours each of combat would provide sufficient data to evaluate the AFAS and its impact on the combat 2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment. A DIS Virtual Environment would allow demonstration of key technologies in automated reaupply of handling, ammunition management, and automated ammunition transfer and docking

#### 2.1 Stated opecifications:

- Unload Rate (PLS to AFAS)
  - Download Rate (AFAS to FARV)
- Exchange Rate (AFAS to FARV)
  - Upload Rate (FARV to AFAS)
- Compatibility (Ammunition Systems) Compatibility (Ammunition)
  - Decision Aid Capability
    - Interoperability
- Communications
  - Data Entry
    - Selectability Storage
- **Docking Under Cover** Control

  - Rapid Disconnect

В

### 2.2 : Other Aspects of Performance Messurable in a DIS Virtual Environment. - 160

- Overall effectiveness of ammunition transfer operations between AFAS, FARV and the LRP
- Effectiveness, timeliness, appropriateness and communications net loading of communications between systems.
- forces, AFAS engagement of these systems could occur. Crew reactions, crew tasks, timeline analysis, weapon engagements and results could be gathered and the results assessed by different ammunition transfer technologies and their impact on the battle. This sequence of events could evaluate the overall impact on system and crew's capability to meet battlefield and system rearm and resupply requirements. Placing the AFAS simulator on a combined arms virtual battlefield may not permit validations of some aspects as specified in the AFAS specification. However, the overall impact of design capabilities can be measured in terms of the battle outcomes at the conclusion of the experiment/scenario. Listed below are example battle statistics and conclusions that testers/analysts may derive from the data elements in the above matrix to the same experiment repeatedly altering or invoking system capabilities. The experiments should be run against approved Training and Doctrine Command (TRADOC) scenarios appropriate to the AFAS System Threat Assessment Report (STAR) and at combat tempo in accordance with the approved Operational Mode Summary/Mission Profile (OMS/MP). For example if the scenario contains threat air and ground 2.3 Sample Experiment. A single experiment/scenario in the DIS virtual environment can address each of the specifications and other aspects of performance outlined above. Analysis and testers can run correlate experiment results to design capabilities and/or changes:
- Median Times of Upload, Download, Unload, Exchange and Transload Operations
  - Average Rate of Upload, Download, Unload, Exchange and Transload Operations
    - Accuracy of Upload, Download, Unload, Exchange and Transload Operations
      - Compatibility with Ammunition combinations by type
- Compatibility with Ammunition systems
- Number and type of reload operations conducted

- Number and types of projectile/fuze combinations resupplied
  Number and type of resupply operations conducted with Decision Aids
  Number and type of resupply operations conducted without Decision Aids
  - Accuracy and quantity of messages by type related to resupply operations Number and type of manual reload operations conducted
    - Number of rapid disconnect operation conducted
- Number of reload operations conducted from an external power source

# Subject of Experimentation/Testing: AFAS Ammunition Transfer Operations

- One AFAS crew to man an AFAS simulator
  One FARV crew to man an FARV simulator
  One FARV crew to man an FARV simulator equipped with radios, moderns, crew displays, supporting software
  One FARV simulator equipped with radios, moderns, crew displays, supporting software
  One FARV simulator equipped with radios, moderns, crew displays, supporting software
  One AFANV simulator equipped with radios, moderns, crew displays, supporting software
  One AFANV sequence and submit calls for fire during centralized AFAS operations, automatically relay calls for fire during centralized AFAS operations and battlefield information.
  One AFANV SAFOR to support senior to subordinate AFAS operations
  One AFAS and FARV SAFOR to support coordination measures and battlefield geometry
  Friendly force operations order with fire support coordination measures and battlefield geometry
  Friendly SAFOR to execute the order

Subject of Experimentation/Testing: FARV Ammunition Transfer Operations

Specifications	Environments for   Measures of	Measures of	Characteriatics and Their Data Elements for	Evicting Madified of New DIS PINIS Beautiers to
•	Teeting	Performance	Collection if DIS Virtual Simulation is	Collect Data Elements
7.56 × 7.	Experimentation		Appropriate Environment	(X = Unsupportable by DIS PDUs)
Opiosa Kate (Supply Foint to FAKV).	Live or Virtual		Time	A combination of the Service Request PDU,  Recurrely Offer PDU Become Becaused PDU
Upload 130 complete rounds in less than 65		Median	Time upload finished	Resupply Cancel PDU and Event Report PDU can
(CCL) on a PLS truck or grounded flatrack		Time of	Time upload started Number of rounds loaded	accommodate the data elements for this function.
At this resupply point as part of the upload			Number of liters LP propellant loaded	
process, the FARV personnel shall prepare the ammunition for storage aboard the			Type of upload (Fully Automated, Semi- Automated or Manual)	
FARV.			Number of crew members	
			Rate	
		Average	Total time required to conduct upload	
		Upload Rate	Number of fronts to deed	
			Number of inters LP propellant loaded  Type of infload (Fully Automated Semi-	
			Automated or Manual)	
			Number of crew members	
			Accuracy	
		Accuracy of	Actual round count by projectile fuze	
		Upload	combination, and fuze and projectile lot	
			System round count by projectile fuze	
Download (AEAS to EADV)	Line or Within		Tri	
				Resumbling Offer PDI   Reumaly Received PDI
Once the AFAS and FARV are within 8		Median	Time when the FARV is again capable of	Resupply Cancel PDU and Bvent Report PDU can
facing each other and supply ports are		Download	maneuver (Stop Time)	accommodate the data elements for this function.
automatically maneuver, dock, transfer 60		2 = = =	time when the system initiates a maneuver to conduct docking (Start Time)	
complete rounds (excluding Copperhead)			Number of rounds loaded	
and undock with AFAS, on slopes (in any			Number of liters LP propellant loaded	
direction) of up to 10 degrees between vehicles (resultant angle) in any operational			Time stopped transfer of 2 Copperheads  Time etaded transfer of 2 Copperheads	
condition in less than 12 minutes.			Time states that see of a copperinguis	
The AEAS craw must be able to manually			Rate	-
transfer 2 Copperhead to the PARV within		Average	Total time required to conduct download	-
the time standard established for automated		Download	Number of rounds downloaded	
download.		Rate	Number of liters LP propellant downloaded	
When required for maintenance or other			Type of download (Automated or Manual)	
operational reasons, fuzed projectiles and			Accuracy	
liquid propellant shall be capable of being				
manually downloaded at a rate of at least 130		Accuracy of	Actual round count by projectile fuze	
complete rounds in less than 90 minutes		Download	Combination, and fuze and projectile lot	
איננו עוכ שלפינון ווו פון מון סאיכוכט פופוב.			System round count by projective rate combination, and fuze and projective lot	

Subject of Experimentation/Testing: FARV Ammunition Transfer Operations

Specifications	Environments for Testing/ Experimentation	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Elements (X = Unsupportable by DIS PDUs)
Download (FARV to FARV).	Live or Virtual		Time	A combination of the Service Request PDU, Resumply Offer PDU, Resumply Received PDI
The FARV must be capable of cumpletely and automatically downloading 130 complete rounds (excluding Copperhead) to another FARV within 20 minutes after docking.		Median download time	Time last item (projectile, LP or fuel) passed through the rearm port. (Stop Time)  Time docking (FARV to FARV) was verified (Start Time)  Time stopped transfer of 2 Copperheads Time started transfer of 2 Copperheads	Resupply Cancel PDU and Bvent Report PDU can accommodate the data elements for this function.
The FARV crew must be able to manually transfer 2 Copperhead to another FARV within the time standard established for automated download.			Number of rounds downloaded Number of liters LP propellant downloaded Rate	
		Average Download Rate	Total time required to conduct download Number of rounds downloaded Number of liters LP propellant downloaded Type of download (Automated or Manual)	
			Accuracy	
		Accuracy of Download	Actual round count by projectile fuze combination, and fuze and projectile lot System round count by projectile fuze combination, and fuze and projectile lot	
Uniosa (FARV to Ground).	Live or Virtual		Time	A combination of the Service Request PDU, Recurry Offer PDI   Became PDI
The FARV must have the capability to automatically unload 130 complete rounds (fuzed projectiles and LP propellant to		Median Untoad Time	Time unload finished Time unload started Number of rounds unloaded	Resupply Cancel PDU and Event Report PDU can accommodate the data elements for this function.
containers) to a CCL flatrack or to the ground in less than 30 minutes.			Number of liters LP propellant unloaded Type of unload (Fully Automated, Semi- Automated or Manual) Number of crew members	
The FARV crew must be able to manually unload 130 complete rounds (fuzed provides and 1 Provided to CC)			Raie	
less than 90 minutes		Average Unload Rate	Total time required to conduct unload Number of rounds unloaded Number of liters LP propellant unloaded Type of unload (Fully Automated, Semi-Automated or Manual) Number of crew members	
			Accuracy	
		Accuracy of Unload	Actual round count by projectile fuze combination, and fuze and projectile lot System round count by projectile fuze combination, and fuze and projectile lot	

Subject of Experimentation/Testing: FARV Ammunition Transfer Operations

Specifications	Environments for Testing/ Experimentation	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Elements (X = Unsupportable by DIS PDUs)
Exchange (AFAS to FARV).	Live or Virtual		Time	A combination of the Service Request PDU,  Requirely Offer PDI   Beautiful Because PDI
The FARV shall be capable of receiving ammunition from the AFAS at a rate of not less than 3 complete processed rounds of primary armament munitions (except Copperhead) per minute.  The exchange of 60 complete processed rounds of primary armament shall take no longer than 20 minutes.		Median Exchange Time	Time last round crosses the resupply port (Stop Time)  Time the first round is passed through the resupply port (Stop Time)  Number of rounds unloaded  Number of liters LP propellant unloaded Type of unload (Fully Automated, Semi-Automated or Manual)  Number of crew members	accommodate the data elements for this function.
			Rate	
		Average Exchange Rate	Total time required to conduct unload Number of rounds unloaded Number of liters LP propellant unloaded Type of unload (Fully Automated, Semi-Automated or Manual)	
			Accuracy	
		Accuracy of Unload	Actual round count by projectile fuze combination, and fuze and projectile lot System round count by projectile fuze combination, and fuze and projectile lot	
Transload (FARV to FARV).	Live or Virtual		Time	A combination of the Service Request PDU,
A FARV shall be capable of automatically transferring 130 complete processed rounds of primary armament munitions (except Copperhead) to another FARV within 20 minutes after docking.		Median Transload Time	Time both FARVs undocked (Stop Time) Time docking was confirmed (Start Time) Number of rounds transloaded Number of liters LP propellant transloaded Type of transload (Fully Automated, Semi-Automated or Manual) Number of crew members	Resupply Cancel PDU and Event Report PDU can accommodate the data elements for this function.
			Rate	
		Average Transload Rate	Total time required to conduct transload Number of rounds transloaded Number of liters LP propellant transloaded Type of transload (Fully Automated, Semi-Automated or Manual) Number of crew members	-
			Accuracy	
		Accuracy of Transload	Actual round count by projectile fuze combination, and fuze and projectile lot System round count by projectile fuze combination, and fuze and projectile lot	

Subject of Experimentation/Testing: FARV Ammunition Transfer Operations

Specifications	Environments for Testing/ Experimentation	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Elements  (X = Unsupportable by DIS PDIA)
Rearm (FARV to AFAS).  Once the AFAS and FARV are within 8 meters of each other and supply ports are facing each other, the FARV must be able to	Live or Virtual	Median Resupply Time	Time Time when the FARV is again capable of maneuver (Stop Time) Time when the system initiates a maneuver to	A combination of the Service Request PDU, Resupply Offer PDU, Resupply Received PDU, Resupply Cancel PDU and Event Report PDU can accommodate the data elements for this function.
automatically maneuver, dock, transfer 60 complete rounds (excluding Copperhead) and undock with AFAS, on slopes (in any direction) of up to 10 degrees between vehicles (resultant angle) in any operational condition in less than 12 minutes.			conduct docking (Start Time)  Number of rounds resupplied  Number of liters LP propellant loaded  Time stopped transfer of 2 Copperheads  Time started transfer of 2 Copperheads	
The FARV crew must be able to manually transfer 2 Copperhead to the AFAS within the time standard established for automated resupply.		Average Resupply Rate	Rate  Total time required to conduct resupply Number of rounds resupplied Number of liters LP propellant resupplied Type of resupply (Automated or Manual)	
		Accuracy of	Accuracy Actual round count by projectile fuze	
		Download	combination, and fuze and projectile lot System round count by projectile fuze combination, and fuze and projectile lot	
Compatibility (Ammunition).  The FARV must be capable of automatically handling all current and developmental (those fielded or in EMD before the start of FARV EMD) fuzed U.S. 155mm projectiles not exceeding 1 meter in length.	Live		Compatbility Record of incidents when ammunition was not compatbility Reason for incompatibility	New entity type values need to be defined for several types of munitions not currently defined in DIS standards.
Projectiles - M107, M110, M110A1, M110A2, M116A1, M121A1, M449, M449A1, M485A1, M485A2, M804, M483A1, M483A2, M687, M692, M718, M718A1, M731, M741, M741A1, M795, M825A1, M549A1, M864, XM867, XM898, XM951, XM971 and XM982.				
Fuzes - M739 (PD), MK399 Mod 1, M762 (ET), XM767 (ET) and XM773 (MOFA)				
M712 Copperhead may be loaded and transferred to AFAS manually.				
Compatibility (Ammunition Systems). The FARV must be capable of operating with	Live or Virtual		Compatibility	Not Applicable
current and developmental munitions packaging systems and automated loading systems (those fielded or in EMD and before the start of FARV EMD).			Type of automated loading system used (AIRRS, FAAPS, etc.)  Type of munitions packaging system used (PLS Flatrack, pallets, etc.)  Type of loading operation conducted (Automated, Semi-Automated or Manual)	

Subject of Experimentation/Testing: FARV Ammunition Transfer Operations

Specifications	Environments for Measures of	Measures of	Characteristics and Their Data Elements for	Existing, Modiffed, or New DIS PDUs Required to
•	Testing	Performance	Collection if DIS Virtual Simulation is	Collect Data Elements
	Experimentation		Appropriate Environment	(X = Unsupportable by DIS PDUs)
Decision Aid Capability.	Live or Virtual		Capability	
The FARV must have an embedded decision				
aid capability to assist the crew in making			Number of resupply and support operations	Event Report PDU
tactical decisions associated with conducting			conducted with Decision Aids	
and managing resupply and support			Number of resupply and support operations	Event Report PDU
operations.			conducted without Decision Aids	,
			Crew comments on operations conducted with and without Decision Aids	×
Interoperability.	Live or Virtual		Completeness	
The FARV system shall be compatible with				
and integrate C3I actions with the Advanced		Percent of	Number of messages received by the FARV	Signal PDU
Field Artillery Tactical Data System		Incoming	Number of messages properly acknowledged	Signal PDU
(AFATDS).		message	(ACK)	•
		translated	Number of messages not acknowledged (NAK)	Signal PDU
The FARV system, at least through the		without		
Dem/Val phase, shall be fully compatible		error		
and interactive with TACFIRE Version 10,				
FSS-IS-1171.		Percent of	Number of messages sent by the system	Signal PDU
		outgoing	Number of messages properly acknowledged	Signal PDU
The FARV must interface with the C31		messages	(ACK) by the receiver	
architecture of AFAS.		translated	Number of messages not acknowledged (NAK)	Signal PDU
		without	by the receiver	
		error		

Subject of Experimentation/Testing: FARV Ammunition Transfer Operations

Communications.  The FARV must provide intervehicular voice communications and digital transfer of data between the FARV and AFAS, or another FARV when connected for resupply/download operations.			שלים ביו	(X = Unsupportable by DIS PDUs)
voice communications and digital transfer of data between the FARV and AFAS, or another FARV when connected for resupply/download operations.	Live or Virtual		Completenese	
data between the FARV and AFAS, or another FARV when connected for resupply/download operations.	<u>-</u>	Jo .	Number of automated resupply operations	Event Report PDU
resupply/download operations.	<u>-</u> -	digital	attempted Number of automated resupply operations	Event Report PDU
		data during resupply operations	Records of digital transfer of data Record of intervehicular voice communications during resupply operations	Signal PDU
	· · · · · ·		Accuracy	
The POC shall be automatically informed of		Percent of	Number of on-board ammunition status changes	Signal PDU
the current on-board ammunition inventory	- 91	Inventory	Type of operation (rearm, upload, download, transload, correction, etc.)	Signal PDU
the L.R.P.	<del></del>	s sent	Number of on-board ammunition inventory messages sent	Signal PDU
When the FARV is docked with an AFAS or		<del></del>	Compatibility	
another FARV, voice/data communications chall be established and automatically		Percent of	Number of dockings	Event Report PD()
initiated as a part of the mating of two			Number of data exchanges conducted to initiate	Signal PDU
vehicles in preparation for resupply. This link shall provide for the transfer of all		automated	and control interchange of data between systems	
control data required to coordinate the		links		
transfer processes.			Capability	
When uploading ammunition and fuel to		Percent of	Number of data exchanges initiated between	Signal PDU
Communications Subsystem shall	<u> </u>		Number of data exchanges conducted between	Signal PDU
send/receive data to/from the AFAS or		anges	systems	
another FARV over the communications				
Management and Control Subsystem.			Accuracy	
		7		
the on-board ammunition inventory shall be automatically updated after each upload,		successful	Number of instances where inventory required	Event Report PDU
download, rearm, or other supply	<u></u>	٥	update	
transaction which requires changes to on- board inventory information.	<u>-</u>	n updates	Reason for update (rearm, upload, download, transload, correction, etc.)	Event Report PDU
	-		Accuracy	
When conducting resupply operations		Accuracy of	Number of fuzed projectiles by lot, fuze, type and Signal PDU	Signal PDU
(Manual and with FARV or AFAS), the C3	-	resupply	weight transferred by sending system	
Subsystem shall transmit (when		data	Number of fuzed projectiles by lot, fuze, type and I	Event Report PDU
the following information, as applicable: LP	•	29	Number of LP liters transferred by sending	Signal PDU
lot number (if required) and quancity, quantity of fuel, projectile			system  Number of LP liters accepted by receiving system	Event Report PDU
lot number, fuzed weight, fuze model and			Type of operation (rearm, upload, download, transland, correction, etc.)	Signal PDU

Subject of Experimentation/Testing: FARV Ammunition Transfer Operations

Specifications	Environments for Testing/ Experimentation	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Elements (X = Unsupportable by DIS PDUs)
Data Entry.  The FARV must be able to automatically read data from a projectile coding system that covers type of projectile, type of fuze, lot number of fuze, lot number of fuze, lot weight.	Live or Virtual	Percent of correct projectile coding events	Accuracy  Number of attempts to read projectile data  Number of projectiles and data accepted by the system  Accuracy	Event Report PDU Event Report PDU
		Accuracy of reading projectile data	Record of data read by the projectile coding system by type of projectile, type of fuze, lot number of fuze, lot number of fuze, lot number of propellant, lot number of projectile, and fuzed projectile weight Record of actual projectile data by type of projectile, type of fuze, lot number of fuze, lot number of projectile, and fuzed projectile, and fuzed projectile weight.	Event Report PDU  Event Report PDU
			Accuracy	
The FARV crew must be able to manually enter data into the FARV system including type of fuze, type of fuze, lot number of fuze lot number of number of fuze lot numb		Accuracy of manual entry of projectile	Record of data entered by operator by type of projectile, type of fuze, lot number of fuze, lot number of projectile, and fuzed projectile weights	Bvent Report PDU
projectile, and fuzed projectile weight.		data	Record of actual projectile data by type of projectile, type of fuze, lot number of fuze, lot number of projectile,	Event Report PDU
			Record of observed operator input errors	Event Report PDU
	Live or Virtual		Accuracy	
fuze/projectile combinations as requested by the receiving system.		Percent of requests satisfied	Record of data requested by receiving system Record of data provided by sending system Record of automated ammunition selection	Signal PDU Signal PDU Signal PDU
The FARV must provide for automated ammunition selection, transfer, cataloging and inventory of fuzed projectiles, fuel and propellant.			requests by quantity of propellant, type of projectile, type of fuze, lot number of fuze, lot number of projectile, and fuzed projectile weight Record of requested quantities furnished by quantity of propellant, type of projectile, type of fuze, lot number of propellant,	Signal PDŲ
			tot number of projective, and tuzed projective weight	

Subject of Experimentation/Testing: FARV Ammunition Transfer Operations

Specifications	Environments for Testing/	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Elements (X = Unsupportable by DIS PDUs)
Storage.	Live or Virtual		Capability	
the resupply subsystem snall store, within the integral structure of the vehicle, at least			Number of complete processed rounds stored	Event Report PDU
130 complete processed rounds of primary			Number of Copperhead rounds stored	Event Report PDU
armament munitions. The Copperhead			Storage location for Copperhead propellant and	Event Report PDU
propellant will be stored with the propellant			rounds	
from the other 130 complete processed			Quantity of LP and Copperhead propellant stored	Event Report PDU
rounds.			Record of data system inventory by quantity of propellant, two of projectile, two of first lot	Event Report PUU
Stowed primary armament amminition			number of fize lot number of propellant lot	
shall be accessible by the crew without			number of projectile, and fuzed projectile weight	
having to exit the vehicle.				
Rapid Disconnect. The AFAS shall be able to	Live or Virtual		Time	
undock from a FARV within 10 seconds				
with no damage to components, no kess of		· · · · · · · · · · · · · · · · · · ·	Time rapid disconnect action completed	Event Report PDU
projectiles, and minimal spillage of fuel and		rapid	Time rapid disconnect action initiated	Event Report PDU
liquid propellant.		disconnect	Record of damage to components	Event Report PDU
•		time	Record of lost projectiles	Event Report PDU
			Record of LP spillage	Event Report PDU
			Record of fuel spillage	Event Report PDU
Power. The AFAS must be able to accept	Live or Virtual		Capability	
sufficient power from an external source to			•	
enable the AFAS to download ammunition,			Record of instances where external power was	Event Report PDU
run diagnostic routine or start the engine.			required	
			Record of instances were external power was	Event Report PDU
			applied and successful	
Docking under cover. The AFAS shall be able to dock with a BARV without requiring	Live or Virtual		Capabillity	
the crew to leave the crew compartment.			Record of dockings with crew out of	Event Report PDU
			Compartment	
			Record of dockings with crew in compartment	Event Report PDU
Control. During transfer of munitions or	Live or Virtual	Percent of	Accuracy	
fuel, the C3 Subsystem shall permit the		error of		
system receiving ammunition, LP and fuel		resupply	Number of instances where receiver (controller)	Signal PDU
to control the resupply process (request		commands	issued commands	
ammunition orders, issue			Number of instances where sender (controller)	Signal FDU
stop/go/disconnect commands, etc.). Inis			Property actioned the requested command  The of instruction issued (request amminision)	Signal PDI
			orders issue shoo/on/disconnect commands. etc.)	
			Number of emergency interruptions	Signal PDU
			Passon for emergency intermination	Claric Brain

# Subject of Experimentation/Testing: FARV Ammunition Transfer Operations

for levels and integration of automation, expert (decision aids) systems and controls/displays. The assessment of the adequacy, maturity and compatibility of ammunition transfer operations could be made based on results of the experiments. Several iterations of simulated battle covering 48 to 96 hours each of combat would provide sufficient data to evaluate the PARV and its impact on the ammunition, propellant and fuel. It would also permit evaluation of reduced rearm time, payload capability (130 to 200 rounds), crew size and workload task analysis. The system could be looked at would permit evaluation and development of selected technologies. DIS experiments could demonstrate the suitability of the new technologies being applied to the FARV covering automation. combat support system in terms of resupply priorities, requisitions, configurations of CCL loads, types and quantities of ammunition requested, fired and returned. A DIS experimental approach 2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment. A DIS Virtual Environment would allow demonstration of key technologies in automated resupply of advanced propellant handling, ammunition management, and automated ammunition transfer and docking.

#### 2.1 Stated specifications:

- Upload Rate (PLS to AFAS)
- Download Rate (AFAS to FARV)
  - Exchange Rate (AFAS to FARV)
- Upload Rate (FARV to AFAS) Compatibility (Ammunition)
- Compatibility (Ammunition Systems) Decision Aid Capability
  - Interoperability
- Communications
  - Data Entry
  - Selectability
- Control

Storage

- Docking Under Cover
- Rapid Disconnect
- Overall effectiveness of ammunition transfer operations between AFAS, FARV and the LRP

2.2 : Other Aspects of Performance Measurable in a DIS Virtual Environment.

- Effectiveness, timeliness, appropriateness and communications net loading of communications between systems.
- forces, FARV engagement of these systems could occur. Crew reactions, crew tasks, timeline analysis, weapon engagements and results could be gathered and the results assessed by different annuality to meet battlefield and system rearm and resupply requirements. Placing the technologies and their impact on the battle. This sequence of events could evaluate the overall impact on a system rearm and resupply requirements. Placing the FARV simulator on a combined arms virtual battlefield may not permit validations of some aspects as specified in the FARV specification. However, the overall impact of design capabilities can be measured in the same experiment repeatedly altering or invoking system capabilities. The experiments should be run against approved Training and Doctrine Command (TRADOC) acertarios appropriate to the FARV System Threat Assessment Report (STAR) and at combat tempo in accordance with the approved Operational Mode Summary/Mission Profile (OMS/MP). For example if the acertario contains threat air and ground terms of the battle outcomes at the conclusion of the experiment/scenario. Listed below are example battle statistics and conclusions that testers/analysts may derive from the data elements in the above matrix to 2.3 Sample Experiment. A single experiment/scenario in the DIS virtual environment can address each of the specifications and other aspects of performance outlined above. Analysis and testers can run correlate experiment results to design capabilities and/or changes:
- Median Times of Upload, Download, Unload, Exchange and Transload Operations
  - Average Rate of Upload, Download, Unload, Exchange and Transload Operations Accuracy of Upload, Download, Unload, Exchange and Transload Operations
- Compatibility with Ammunition combinations by type
  - Compatibility with Ammunition systems
- Number and type of reload operations conducted
- Number and types of projectile/fuze combinations resupplied
- Number and type of resupply operations conducted with Decision Aids
- Number and type of resupply operations conducted without Decision Aids Accuracy and quantity of messages by type related to resupply operations
  - Number and type of manual reload operations conducted
    - Number of rapid disconnect operation conducted

Number of reload operations conducted from an external power source

3. Required Resources. To support experimentation and testing in the areas identified above the following resources are required:

Subject of Experimentation/Testing: FARV Ammunition Transfer Operations

- One AFAS crew to man an AFAS simulator
  One FARV crew to man an FARV simulator
  One FARV simulator equipped with radios, modems, crew stations, crew displays, supporting software
  One AFAS simulator equipped with radios, modems, crew stations, crew displays, supporting software
  One PARV simulator equipped with radios, modems, crew stations, crew displays, supporting software
  One PARV simulator equipped with radios, modems, crew stations, crew displays, supporting software
  One irre direction computer to process the observer's call for fire during centralized AFAS operations, computer to process the observer's call for fire during centralized AFAS operations, resupport sentor to subordinate AFAS operations
  One AFAS and FARV SAFOR to support sentor to subordinate AFAS operations
  Friendly force operations order with fire support coordination measures and battlefield geometry
  Friendly SAFOR to execute the order

Subject of Experimentation/Testing: AFAS LRP Operations

Specifications	Environments for		Characteristics and Their Data Elements for	Existing, Modified, or New DIS POUs Required to
J.,	Testing/ Experimentation	Performance	Collection if DIS Virtual Simulation is Appropriate Environment	Collect Data Elements (X = Unsupportable by DIS PDUs)
Manual/Assisted Tasks. The APAS shall	Live	Median	Time	
requiremental the processing of munitions		Manual Task Linhad	Time infload stonned	×
to include actions delineated below:		Time	Time upload started	· ×
			Record of manual tasks	×
1. Open ruze crates				
2. hecord ruze lot			Custoria	
4. Break projectile pallets		Average	Number of rounds remaining on PLS flatrack	<b>×</b>
5. Remove projectile rotating band		Number of	Number of rounds on PLS flatrack at start	×
grommets and lifting plug		Rounds	Record of system inventory by projectile and	×
6. Remove projectile rocket motor or		Loaded	fuze, lot, type, quantity and fuzed projectile weight.	
basebleed nozzle caps			Type of upload (manual or semiautomated)	×
vanor harriera			e de Ca	
R Record projectile lot				
9. Inspect projectile		Average	Number of projectiles loaded	×
10. Insert fuze	_	Loading	Time required to load projectiles	×
11. Weigh projectile/fuze combination		Rate	•	
12. Mark projectile (type, fuze, weight,	_	(Manual)		
projectile lot, fuze ,lot)			Time	
13. Record all shell/fuze data in the			i	,
onboard computerized inventory		Medica	Time upload stopped	~ <b>~</b>
management system		Median	December of manual teats and formed	< >
14. Flaced ruzed projectile onto loading	_	semiautom	Necord of manual tasks performed	< >
mechanism		Tipload	necord of automated table performed	<
		Time		
			Quantity	
			Misself of Grands among the contract of the contract of	>
	_	Average	Number of rounds on PLS flatrack at start	< ×
		Number of	Record of system inventory by projectile and	
	_	Rounds	fuze, lot, type, quantity and fuzed projectile weight.	-
		Loaded	Type of upload (manual or semiautomated)	×
			Rate	
			•	;
		Average	Number of projectities toaded Time required to load projectiles	××
		Rate		
		(Semiantom		
		ated)		

Subject of Experimentation/Testing: AFAS LRP Operations

Existing, Modified, or New DIS PDUs Required to Collect Data Elements (X = Unsupportable by DIS PDUs)	A combination of the Service Request PDU, Resupply Offer PDU, Resupply Received PDU, Resupply Cancel PDU and Event Report PDU can accommodate the data elements for this function.					A combination of the Service Request PDU, Resupply Offer PDU, Resupply Received PDU, Resupply Cancel PDU and Event Report PDU can accommodate the data elements for this function.				
Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Time upload finished Time upload started Number of rounds loaded	Number of liters Lf propellant loaded  Type of upload (Fully Automated, Semi-Automated or Manual)  Number of crew members  Rate	Total time required to conduct upload Number of rounds loaded Number of liters LP propellant loaded Type of upload (Fully Automated, Semi-Automated or Manual) Number of crew members	Accuracy	Actual round count by projectile fuze combination, and fuze and projectile lot System round count by projectile fuze combination, and fuze and projectile lot	Time unload finished Time unload started Number of rounds unloaded Number of liters LP propellant unloaded Type of unload (Fully Automated, Semi-Automated or Manual)	Rate	Total time required to conduct unload Number of rounds unloaded Number of liters LP propellant unloaded Type of unload (Fully Automated, Semi-Automated or Manual)	Accuracy	Actual round count System round count
Measures of Performance	Median Time of Upload		Average Upload Rate		Accuracy of Upload	Median Unload Time		Average Unload Rate		Accuracy of Unload
Environments for Testing/ Experimentation	Live or Virtual					Live or Virtual				
Specifications	When the FARV is unavailable, the AFAS shall be capable of supporting a crew performed manual upload of fuzed	projectities and propellant from combat configured loads on PLS flatracks at an average rate of one complete round per minute. The upload (rearm) function includes required processing of fuzes and projectitles plus data entry including type of	projectile, type of fuze, lot number of fuze, lot number of propellant, lot number of projectile, and fuzed projectile weight.			Unload (AFAS to Ground). The AFAS crew must be able to manually unload 60 complete rounds (fuzed projectiles and LP propellant) to a CCL flatrack or the ground (LP to containers) in less than 45 minutes.				

Subject of Experimentation/Testing: AFAS LRP Operations

Specifications	Environments for		Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs Required to
	I esting	rertormance	Collection if Dis Virtual Simulation is Appropriate Environment	Collect Data Elements (X = Unsupportable by DIS PDUs)
Compatibility (Ammunition Systems). The	Live or Virtual		Compatibility	Not Applicable
current and developmental munitions			Type of automated loading system used (AIRRS,	
packaging systems and automated loading			FAAPS, etc.)	
systems (those fielded or in EMD and before the start of AFAS EMD).			Type of munitions packaging system used (PLS) Flatrack, pallets, etc.)	
			Type of loading operation conducted (Automated, Semi-Automated or Manual)	
Data Entry.	Live or Virtual		Accuracy	
data from a projectile coding system that		Percent of	Number of attempts to read projectife data	Event Report PDU
covers type of projectile, type of fuze, lot		correct	Number of projectiles and data accepted by the	Event Report PDU
number of fuze, lot number of propellant, for number of projectile, and fuzed projectile		projectife	system	
weight.		events	Accuracy	
		Accuracy of	Record of data read by the projectile coding	Event Report PDU
		reading	system by type of projectile, type of fuze, lot	
		data	number of projectile, and fuzed projectile weight	
			Record of actual projectile data by type of	Event Report PDU
			projectile, type of fuze, lot number of fuze, lot number of propellant, lot number of projectile	
			and fuzed projectile weight.	
			Accuracy	
The AFAS crew must be able to manually		Accuracy of	Record of data entered by operator by type of	Event Report PDU
type of projectile, type of fuze, lot number of		entry of	projective, type of tuze, for number of fuze, for number of projective,	
fuze, lot number of propellant, lot number of		projectile	and fuzed projectile weight	ING TOUR
projectile, and ruzed projectile weight.		Gata	record of actual projective data by type of projectile, type of fuze, lot number of fuze, lot	Event Report FDO
			number of propellant, lot number of projectile,	
			and fuzed projectine weight.  Record of observed operator input errors	Event Report PDU
Rapid Disconnect. The AFAS shall be able to	Live or Virtual		Time	
undock from a FARV within 10 seconds		Median	Time rapid disconnect action completed	Event Report PDU
projectiles, and minimal spillage of fuel and		rapid	Time rapid disconnect action initiated	Bvent Report PDU
liquid propellant.		disconnect time	Record of damage to components Record of lost projectiles	Event Report PDU  Event Report PDU
			Record of LP spillage Record of fuel spillage	Event Report PDU Event Report PDU

Subject of Experimentation/Testing: AFAS LRP Operations

		Measures or	Characteristics and I heir Data Elements for	existing, modified, of New Dio ribus Required to
	Testing/ Experimentation	Pertormance	Collection if UIS Virtual Simulation is Appropriate Environment	Collect Data Elements (X = Unsupportable by DIS PDUs)
Power. The AFAS must be able to accept	Live or Virtual		Capability	
enable the AFAS to download amountion,			Record of instances where external power was	Event Report PDU
מאווסטור וסחוווה סו פומון ווופ בואוווה:			Record of instances were external power was applied and successful	Event Report PDU
The AFAS must be able to provide sufficient			Capability	
these vehicles to conduct downloading			Record of engine starts where AFAS provided	Event Report PDU
their engines.			Record of diagnostics run where AFAS provided	Event Report PDU
			Record of ammunition downloads operations conducted where AFAS provided external power	Event Report PDU
Communications.	Live or Virtual		Completeness	
voice communications and digital transfer of		Percent of	Number of automated resupply operations	Event Report PDU
data between the AFAS and FARV when		correct	attempted Number of automated resumbly operations	Riverst Report PDI
operations.		transfers of	completed	
		data during resupply operations	Records of digital transfer of data Record of intervehicular voice communications during resupply operations	Signal PDU Signal PDU
			Accuracy	
The POC shall be automatically informed of the current on-board ammunition inventory after each rearm mission and after upload at the LRP.		Percent of inventory status reports sent	Number of on-board ammunition status changes Type of operation (rearm, upload, download, transload, correction, etc.) Number of on-board ammunition inventory	Signal PDU Signal PDU Signal PDU
		_	messages sent	
When the AFAS is docked with a FARV, voice/data communications shall be			Compatibility	
established and automatically initiated as a part of the mating of two vehicles in preparation for resupply. This link shall provide for the transfer of all control data		Percent of successful automated docking	Number of dockings  Number of data exchanges conducted to initiate and control interchange of data between systems	Event Report PDU Signal PDU
required to coordinate the transfer processes.		IIIKS	Capability	
when uploating ammunion and tuel to from a FARV, the Communications Communications	-	Percent of	Number of data exchanges initiated between	Signal PDU
the FARV over the communications link per instructions.		data exchanges	Number of data exchanges conducted between systems	Signal PDU

Subject of Experimentation/Testing: AFAS LRP Operations

•	×	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is	Edisting, Modified, or New DIS PDUs Required to Collect Data Elements
Communications (cont.)	Live or Virtual		Appropriate Environment Accuracy	. (SOCIETY OF THE CONTROL OF THE CON
The on-board ammunition inventory shall		Percent of successful	Number of ammunition inventory updates	Event Report PDU
be automatically updated after each upload, download, rearm, or other supply		n updates	Number of instances where inventory required update	EVENT REPORT PDO
transaction which requires changes to on- board inventory information.			Keason for update (rearm, upload, download, transload, correction, etc.)	Event Report PDU
		A consequence	Accuracy	
When conducting resupply operations		resupply	Number of fuzed projectiles by lot, fuze, type and	Signal PDU
(Manual and with FARV), the AFAS shall transmit (when downloading) or receive		exchange	weight transferred by sending system Number of fuzed projectiles by lot, fuze, type and	Event Report PDU
(When uploading) the following information, as applicable: LP lot number (if			weight accepted by receiving system  Number of LP liters transferred by sending	Signal PDU
required) and quantity, quantity of fuel, projectile model, projectile lot number, fund model and find lot			system Number of LP liters accepted by receiving system Ture of concession treasm unland doubled	Event Report PDU
ימבכת אכוני, ומבב וווספו מות ומבב וסו:			transload, correction, etc.)	
		Median	Time	
		Inventory	Time docking completed	Event Report PDU
		ransmissio n Time	time inventory sent Time inventory received	Signal PDU
			Type of resupply operation (upload, download,	Signal PDU
			Method of operation (automatic or manual)	Event Report PDU
Decision Aid Capability. The AFAS must have an embedded decision	Live or Virtual		Capability	
aid capability to assist the crew in making			Number of resupply and support operations	Event Report PDU
tactical decisions associated with conducting and managing resupply and support			conducted with Decision Aids  Number of resupply and support operations	Event Report PDU
operations.			conducted without Decision Aids	
			Crew comments on operations conducted with and without Decision Aids	<
Docking under cover. The AFAS shall be	Live or Virtual			
able to dock with a FARV without requiring the crew to leave the crew compartment.			Capability	
•			Record of dockings with crew out of	Event Report PDU
			Record of dockings with crew in compartment	Event Report PDU
Undocking under cover. The AFAS shall be able to undock with a FARV without	Live or Virtual		Capability	
requiring the crew to leave the crew			Record of undockings with crew out of	Event Report PDU
compartment.			Compartment Record of undockings with crew in compartment Event Report PDU	Event Report PDU

Subject of Experimentation/Testing: AFAS LRP Operations

Specifications	Environments for Testing/ Experimentation	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing. Modified, or New DIS PDUs Required to Collect Data Elements (X * Unsupportable by DIS PDUs)
Rearm/Resupply Mission Cycle Operations. In order to provide timely resupply to the	Live or Virtual		Time	
maneuver forces, AFAS when operating at the Operational Mode Summary/Mission Profile (OMS/MP), with FARV not available and to survive on the battlefield, the AFAS		Median Travel Time to LRP	Time arrived the LRP Time departed the LRP	Entity State PDU Entity State PDU
must minimize the time required to complete a rearm/resupply mission cycle with efficient and effective operations including travel to and from the LRP and loading operations while at the LRP.		Median Time Required to Conduct Resupply Operations	Time resupply operations stopped Time resupply operations started	Event Report PDU Event Report PDU
		Median Travel Time from LRP	Time AFAS arrived at position Time AFAS departed LRP	Entity State PDU Entity State PDU
		Average Distance Traveled to LRP	Odometer reading when arrived at LRP Odometer reading when started for LRP	Event Report PDU Event Report PDU
		Average Distance Traveled from LRP	Odometer reading when arrived from LRP Odometer reading when departed LRP	Event Report PDU Event Report PDU

## Subject of Experimentation/Testing: AFAS LRP Operations

and the AIRRS system could be made. Selection and development of technologies could be further investigated to determine additional technologies or combination of technologies to pursue. Demonstration of the achievability of the new technologies being applied to the AFAS (automation, advanced propellant handling, ammunition management, and automated done by crew members could be assessed from an operational perspective. The system could be looked at for integration of various levels of automation, expert (decision aids) systems 2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment. A DIS Virtual Environment would allow evaluation of the tactics, techniques and procedures support LRP operations. The capabilities of the Advanced Integrated Robotics Rearm System (AIRRS) or other technologies to automate some ammunition processing tasks presently and controls/displays and their impact on the operational effectiveness on the battlefield. Assessment of the adequacy, maturity and compatibility of ammunition transfer operations and key technologies available to support and conduct LRP operations. It would also permit evaluation and analysis of different technologies and capabilities potentially available to ammunition transfer) could also be made.

#### 2.1 Stated specifications:

- Upload Rate (Supply Point to AFAS)
  - Unload Rate (AFAS to Ground)
- Compatibility (Ammunition Systems)
  - Decision Aid Capability
- Communications
- Data Entry
- Docking Under Cover
- Undocking Under Cover
  - Power
- Rapid Disconnect
- Rearm/Resupply Mission Cycle Operations

# 2.2 : Other Aspects of Performance Measurable in a DIS Virtual Environment. None

- Analysts and testers can run the same experiment repeatedly altering system capabilities. The experiments should be run against approved Training and Doctrine Command (TRADOC) scenarios appropriate to the AFAS System Threat Assessment Report (STAR) and at combat tempo in accordance with the approved Operational Mode Summary/Mission Profile (OMS/MP). For example if the AFAS simulator software has some on-board AIRRS-like, manual and semiautomated rearm/refuel/resupply capabilities, the impact on overall system and crew capability to meet battlefield requirements may be determined and evaluated for their benefit or detriment to mission completion. Placing the AFAS simulator on a combined arms virtual battlefield may not permit validations of some aspects as specified in the AFAS specification. However, the overall impact of design changes can be measured in terms of the battle outcomes at the conclusion of the experiment/scenario. Listed below are example battle statistics and conclusions that testers/analysis may derive from the data elements in 2.3 Sample Experiment. A single experiment/scenario in the DIS virtual environment can address each of the specifications and other aspects of performance outlined above. the above matrix to correlate experiment results to design changes:
- · Median Times of Upload and Unload Operations with and without AIRRS-like capabilities
  - Average Rate of Upload and Unload Operations with and without AIRRS-like capabilities
    - Accuracy of Upload and Unload Operations with and without AIRRS-like capabilities
- · Median Times required to conduct LRP Operations with and without AIRRS-like capabilities
  - Compatibility with ammunition systems
    - Number of missions completed
- Number and type of upload and unload operations conducted
- Number and types of projectile/fuze combinations resupplied Number and type of resupply operations conducted with Decision Aids
- Number and type of resupply operations conducted without Decision Aids
  - Accuracy and quantity of messages by type related to resupply operations
    - Number and type of manual upload and unload operations conducted
- Number of rapid disconnect operations conducted
- 3. Required Resources. To support experimentation and testing in the areas identified above the following resources are required:

#### Subject of Experimentation/Teating: AFAS LRP Operations

- One AFAS crew to man an AFAS simulator
  One AFAS crew to man an AFAS simulator with AIRRS-like capabilities
  One AFAS simulator equipped with BCC, radios, modems, crew stations, crew displays, supporting software
  One AFAS simulator equipped with BCC, radios, modems, crew stations, crew displays, supporting software with AIRRS-like capabilities
  One AFAS SAFOR to support paired howitzer operations
  One FARV SAFOR to support AFAS-to-FARV docking operations
  Several SAFOR PLS CCL Platracks in various configurations (full, partial and empty) to support resupply operations.
  One SAFOR PLS Truck to support I.RP Operations

- One SAFOR fuel truck to support LRP refueling operations
  Various power assisted and hand tools for the AFAS crew members to use in supporting LRP operations
  One FARV SAFOR with AIRRS-like add-on capabilities at the LRP
  A Time Ordered Events List (TOEL)

B - 179

Subject of Experimentation/Testing: FARV LRP Operations

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1. Dat

Specifications	Environments for	Measures of	Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs Required to
	Testing/ Experimentation	Performance	Collection if DIS Virtual Simulation is Appropriate Environment	Collect Data Elements (X = Unsupportable by DIS PDUs)
Manual/Assisted Tasks. The FARV shall	Live	Median	Time	
automate as practicable (to meet upload time		Manual		
requirements) the processing of munitions		Task Upload	Time upload stopped	× >
to include actions delineated below:		e E	lime upload started Record of manual tasks	××
1. Open fuze crates				7
2. Record fuze lot			Quantity	
3. Inspect fuze				
4. Break projectile pallets		Average	Number of rounds remaining on PLS flatrack	×
5. Remove projectile rotating band		Number of	Number of rounds on PLS flatrack at start	×
grommets and lifting plug		Rounds	Record of system inventory by projectile and	×
6. Remove projectile rocket motor or		Loaded	fuze, lot, type, quantity and fuzed projectile weight.	
basebleed nozzle caps			Type of upload (manual or semiautomated)	×
variors harriers			Rate	
A Perced projectile for				
9 Inspect projectile		Average	Number of projectiles leaded	*
10 Togeth firze		Loading	Time required to load projectiles	· ×
11 Weigh projectile /fuze combination		Rate		
12. Mark projectile (type, fuze, weight,		(Manual)		
projectile lot, fuze ,lot)			Time	
13. Record all shell/fuze data in the				
onboard computerized inventory			Time upload stopped	×
management system		Median	Time upload started	×
14. Placed fuzed projectile onto loading		Semiautom	Record of manual tasks performed	×
mechanism		ated Task	Record of automated tasks performed	×
		Upload		
		Time	- C	
			Number of rounds remaining on PLS flatrack	×
		Average	Number of rounds on PLS flatrack at start	××
		Point of	Accord of system inventory by projective and	<
		Loaded	Type of upload (manual or semiautomated)	×
			Kate	
		Average	Number of projectiles loaded	. ×
		Loading	Time required to load projectiles	~~ ×
		(Semiautom		
		ated)		

Subject of Experimentation/Testing: FARV LRP Operations

Specifications	Environments for Measures of	Measures of	Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs Required to
•	Testing/	Performance	Collection if DIS Virtual Simulation is	Collect Data Elements
	Experimentation		Appropriate Environment	(X = Unsupportable by DIS PDUs)
Upload Rate (Supply Point to FARV).	Live or Virtual		Time	A combination of the Service Request PDU, Resupply Offer PDU, Resupply Received PDU.
Upload 130 complete rounds in less than 65		Median	Time upload finished	Resupply Cancel PDU and Event Report PDU can
minutes from a Combat Configured Load		Time of	Time upload started	accommodate the data elements for this function.
(CCL) on a PLS truck or grounded flatrack.		Upload	Number of rounds loaded	
At this resupply point as part of the upload			Number of liters LP propellant loaded	
prixess, the FARV personnel shall prepare			Type of upload (Fully Automated, Semi-	
the ammunition for storage aboard the			Automated or Manual)	
FARV.			Number of crew members	
			Bale	
		Average	Total time required to conduct upload	
		Upload Kate	Number of founds loaded	
			Type of upload (Fully Automated, Semi-	
			Automated or Manual)	
			Number of crew members	
			Accuracy	
		Accuracy of	Actual round count by projectile fuze	
			combination, and fuze and projectile lot	
			System round count by projectile fuze	
			combination, and fuze and projectile lot	
			Time	
		Median	Time departed LRP	
		Time	Time arrived LRP	
		Required to	Record of LRP activity	
		Conduct	Number of projectiles uploaded, unloaded,	
		LRP	transferred, exchanged or downloaded.	
		Operations	:	

Subject of Experimentation/Testing: FARV LRP Operations

Specifications	Environments for Measures of Teeting/ Experimentation	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Elements  (X = Unsupportable by DIS PDUs)
Unload (FARV to Ground).	Live or Virtual		Time	A combination of the Service Request PDU,
The FARV must have the capability to		Median	Time unload finished	Resupply Cancel PDU and Byent Report PDU can
automatically unload 130 complete rounds		Unload	Time unload started	accommodate the data elements for this function.
(fuzed projectiles and LP propellant to	_	Time	Number of rounds unloaded	
containers) to a CCL flatrack or to the ground			Number of liters LP propellant unloaded	
in less than 30 minutes.			Type of unload (Fully Automated, Semi-	
			Automated or Manual)	
			Number of crew members	
the FARV crew must be able to manually unload 130 complete rounds (firsed			A) 4 6	
projectiles and LP propellant) to a CCL				
flatrack or the ground (LP to containers) in		Average	Total time required to conduct unload	
ess toan yo minutes		Unioad nate	Number of liters LP propellant unloaded	
			Type of unload (Fully Automated, Semi-	
			Automated or Manual)	
			Accuracy	
		Accuracy of	Actual round count by projectile fuze	
		Unload	combination, and fuze and projectile lot	
			System round count by projectile fuze	
7			combination, and fuze and projectile for	
Compatibility (Ammunition Systems). The PARV must be capable of operating with	Live or Virtual		Compatibuity	Not Applicable
current and developmental munitions			Type of automated loading system used (AIRRS,	
packaging systems and automated loading			FAAPS, etc.)	
systems (those fielded or in EMD and before			Type of munitions packaging system used (PLS	
the start of FARV EMD).			Flatrack, pallets, etc.)	
			Type of loading operation conducted	

Subject of Experimentation/Testing: FARV LRP Operations

Specifications	Environments for Measures of	Measures of	Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs Required to
	Experimentation	remormance	Collection if Dis Virtual Simulation is Appropriate Environment	Collect Data Elements (X = Unaupportable by DIS PDUs)
Data Entry. The PARV must be able to automatically	Live or Virtual		Accuracy	
read data from a projectile coding system that		Percent of	Number of attempts to read projectife data	Event Report PDU
number of fuze, lot number of propellant, lot		projectile	system	OG I III
weight.	-	events	Accuracy	
		Accuracy of	Record of data read by the projectile coding	Event Report PDU
		projectile	system by type or properties, type or tuze, not number of fuze, lot number of propellant, lot	
		5 6 5 6 5 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	Record of actual projectile data by type of	Event Report PDU
			projective, type of taze, for number of taze, for number of projectile, and fuzed projectile weight.	
			Accuracy	
The FARV crew must be able to manually		Accuracy of	Record of data entered by operator by type of	Event Report PDU
enter data into the FARV system including		manual	projectile, type of fuze, lot number of fuze, lot	
fuze, lot number of propellant, lot number of		projectile	and fuzed projectile weight	
projectile, and fuzed projectile weight.		data	Record of actual projectile data by type of projectile, type of fuze, lot number of fuze, lot	Event Report PDU
			number of propellant, lot number of projectile,	
			and fuzed projective werging.  Record of observed operator input errors	Event Report PDU
Rapid Disconnect. The FARV shall be able to Live or	Live or Virtual		Time	
with no damage to components, no loss of		Median	Time rapid disconnect action completed	Event Report PDU
projectiles, and minimal spillage of fuel and		rapid	Time rapid disconnect action initiated	Bvent Report PDU
liquid propellant.		disconnect	Record of damage to components  Decord of Lost productiles	Event Report PDU
			Record of LP spillage	Event Report PDU
			Record of tuel spillage	Event Report PDU
Power. The FARV must be able to accept	Live or Virtual		Capability	-
enable the FARV to download ammunition,			Record of instances where external power was	Event Report PDU
run diagnostic routine or start the engine.			required Record of instances were external nower was	Event Report PDI
			applied and successful	

Subject of Experimentation/Testing: FARV LRP Operations

Specifications	Environments for Testing/	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is	Existing, Modified, or New DIS PDUs Required to Collect Data Elements (X = Unautoportable by DIS PDUs)
Communications. The BARV must provide intervehicular	Live or Virtual		Completences	
voice communications and digital transfer of		Percent of	Number of automated resupply operations	Event Report PDU
data between the FAKV and AFAS, or another FARV when connected for		correct digital	attempted Number of automated resupply operations	Event Report PDU
resupply/download operations.		- <b>2</b>		Signal PDU
	-	resuppiy operations	Record of intervenicular voice communications during resupply operations	Signal PDD
			Accuracy	
The POC shall be automatically informed of the current on-board ammunition inventory		Percent of inventory	Number of on-board ammunition status changes Type of operation (rearm, upload, download,	Signal PDU
after each rearm mission and after upload at the LRP.		status reports sent	ection, etc.) on-based ammunition inventory	Signal PDU
with me that EADV is docked with an ABAC as			11.00.00 SC 11.	
another FARV, voice/data communications			Companibulty	
shalf be established and automatically initiated as a part of the mating of two			Number of dockings Number of data exchanges conducted to initiate	Event Report PDU Signal PDU
vehicles in preparation for resupply. This link shall provide for the transfer of all		ng ed	and control interchange of data between systems	
control data required to coordinate the transfer processes.		links	Capability	
When uploading ammunition and fuel to		Percent of	Number of data exchanges initiated between	Signal PDU
Communications Subsystem shall send freeing data to from the AFAS or			Systems  systems	Signal PDU
another FARV over the communications				
link per instructions of the Mission Management and Control Subsystem.			Accuracy	
The on-board ammunition inventory shall be automatically updated after each upload,		Percent of successful	Number of ammunition inventory updates Number of instances where inventory required	Event Report PDU Event Report PDU
download, rearm, or other supply		.0	update Reason for undate (rearm, upload, download	Event Report PDU
board inventory information.			transload, correction, etc.)	
			Accuracy	
When conducting resupply operations		Accuracy of	Number of fuzed projectiles by lot, fuze, type and	Signal PDU
FARV shall transmit (when downloading)		data	Number of fuzed projectiles by lot, fuze, type and	Event Report PDU
or receive (when uploading) me following information, as applicable: LP lot number (if		excusurge	weight accepted by receiving system  Number of LP liters transferred by sending	Signal PDU
required) and quantity, quantity of fuel, projectile model, projectile lot number,			system Number of LP liters accepted by receiving system Two of consession feater unland download	Event Report PDU
ruzeu weigin, ruze model and ruze lot.			Type of Operation (Team), upioes, commond, transload, correction, etc.)	

Subject of Experimentation/Testing: FARV LRP Operations

Specifications	Environments for		Characteristics and Their Data Elements for	Existing Modified of New DIS PDUs Required to
	Testing	Performance	Collection if DIS Virtual Simulation ie Appropriate Environment	Collect Data Elements (X = Unaupportable by DIS PDUs)
Decision Aid Capability.	Live or Virtual		Capability	
aid capability to assist the crew in making			Number of removed and enemy towards	
tactical decisions associated with conducting			conducted with Decision Aids	
and managing resupply and support operations.			Number of resupply and support operations conducted without Decision Aids	Event Report PDU
			Crew comments on operations conducted with and without Decision Aids	×
Docking under cover. The AFAS shall be	Live or Virtual			
able to dock with a FARV without requiring the crew to leave the crew compariment.			Capability	
			Record of dockings with crew out of	Event Report PDU
			compartment Record of dockings with crew in compartment	Event Report PD[1
Undocking under cover. The AFAS shall be Live of	Live or Virtual		Capability	
requiring the crew to leave the crew			Percent of inchrobing with reason on the	Doctor B
compartment.			Compartment	Event neport 100
			Record of undockings with crew in compartment Event Report PDU	Event Report PDU
Rearm/Resupply Mission Cycle Operations.	Live or Virtual		Time	
In order to provide timely resupply to the		Modian	Time series	
Operational Mode Summary/Mission Profile		Travel Time	Time departed the LRP	Entity State PDU
(OMS/MP) and to survive on the battlefield,		to LRP		
the FARV must minimize the time required			į	
to complete a rearm/resupply mission cycle with efficient and effective operations		Median	Time resupply operations stopped	Event Report PDU
including travel to and from the LRP and		Required to	זווות וכשחקקין טובנומוסוים ממוכח	Event report FDO
loading operations while at the LRP.		Conduct		
		Operations		
		Median	Time RABV arrived at position	Control Control Dollar
		Travel Time from LRP	Time FARV departed LRP	Entity State PDU
				1
		Average	Odometer reading when arrived at LRP Odometer reading when started for LRP	Event Report PDU Event Report PDU
		Traveled to LRP		-
		Average	Odometer reading when arrived from 18P	From Bonner POII
		Distance	Odometer reading when departed LRP	Event Report PDU
		from LRP		

#### Subject of Experimentation/Testing: FARV LRP Operations

members could be assessed from an operational perspective. The system could be looked at for integration of various levels of automation, expert (decision aids) systems and controls/displays and their impact on the operational effectiveness on the battlefield. Assessment of the adequacy, maturity and compatibility of ammunition transfer operations and the AIRRS system could be made. Selection and development of technologies could be further investigated to determine additional technologies or combination of technologies to pursue. Demonstration of the 2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment. A DIS Virtual Environment would allow evaluation of the tactics, techniques and procedures and technologies and capabilities potentially available to support LRP operations. It would also permit evaluation and analysis of different technologies and capabilities potentially available to support LRP operations. The capabilities of the Advanced Integrated Robotics Rearm System (AIRRS) or other technologies to automate some ammunition processing tasks presently done by crew achievability of the new technologies being applied to the FARV (automation, advanced propellant handling, ammunition management, and automated ammunition transfer) could also be

#### 2.1 Stated opecifications:

- Upload Rate (Supply Point to FARV)
  - Unload Rate (FARV to Ground)
- Compatibility (Ammunition Systems)
  - Decision Aid Capability
- Communications
- Data Entry
- Docking Under Cover
- Undocking Under Cover
- Rapid Disconnect
- Rearm/Resupply Mission Cycle Operations

## 2.2 : Other Aspects of Performance Measurable in a DIS Virtual Environment. None

2.3 Sample Experiment. A single experiment/scenario in the DIS virtual environment can address each of the specifications and other aspects of performance outlined above. Analysts and testers can run the same experiment repeatedly altering system capabilities. The experiments should be run against approved Training and Doctrine Command (TRADOC) accordance appropriate to the FARV System Treat Assessment Report (STAR) and at combat tempo in accordance with the approved Operational Mode Summary/Mission Profile (OMS/MP). For example if the FARV simulator software has some on-board AIRRS-like, manual and semiautonmated rearm/refuel/resupply capabilities, the impact on overall system and crew capability to meet battlefield requirements may be determined and evaluated for their benefit or detriment to mission completion Placing the FARV simulator on a combined arms virtual battlefield nay not permit validations of some aspects as specified in the FARV specification. However, the overall impact of design changes can be measured in terms of the battle outcomes at the conclusion of the experiment/scenario. Listed below are example battle statistics and conclusions that testers/analysts may derive from the data elements in the above matrix to correlate experiment results to design changes: В - 186

- Median Times of Upload and Unload Operations with and without AIRRS-like capabilities
  - Average Rate of Upload and Unload Operations with and without AIRRS-like capabilities
- Accuracy of Upload and Unload Operations with and without AIRRS-like capabilities Median Times required to conduct LRP Operations with and without AIRRS-like capabilities
  - Compatibility with Ammunition systems
- Number and type of upload and unload operations conducted Number of missions completed
- Number and types of projectile/fuze combinations resupplied
- Number and type of resupply operations conducted without Decision Aids Number and type of resupply operations conducted with Decision Aids
  - Accuracy and quantity of messages by type related to resupply operations
    - Number and type of manual upload and unload operations conducted

      - Number of rapid disconnect operations conducted

#### Subject of Experimentation/Testing: FARV LRP Operations

- 3. Required Resources. To support experimentation and testing in the areas identified above the following resources are required:

- One FARV crew to man an FARV simulator
  One FARV crew to man an FARV simulator with AIRRS-like capabilities
  One FARV crew to man an FARV simulator with AIRRS-like capabilities
  One FARV simulator equipped with radios, modems, crew stations, crew displays, supporting software with AIRRS-like capabilities
  One FARV SAFOR to support AFAV to-FARV docking operations
  One FARV SAFOR PLS CCL Flatracks to various configurations (full, partial and empty) to support resupply operations
  One SAFOR PLS Truck to support LRP refueling operations
  One SAFOR PLS Truck to support LRP refueling operations
  One SAFOR PLS Truck to support LRP refueling operations
  One FARV SAFOR with AIRRS-like add-on capabilities
  A Time Ordered Events List (TOEL)

Subject of Experimentation/Testing: AFAS Degraded Operations

	- 1		5	
Specifications	Environments for Testing	Measures of Performance	Characteristics and Ineit Data Elements for Collection if DIS Virtual Simulation is	Existing, Modified or New Dis PDUs Required to Collect Data Elements
	Experimentation		Appropriate Environment	(X = Unsupportable by DIS PDUs)
Download (AFAS to FARV). The AFAS	Live or Virtual		Time	
must allow the crew to manually unload		Modia	Time when the GADV is series of	
and LP propellant) to a FARV, a CCL		Download	maneuver (Stop Time)	Even report 100
flatrack or the ground (LP to containers)		Time	Time when the system initiates a maneuver	Event Report PDU
in less than 45 minutes.			to conduct docking (Start Time)	
			Number of rounds loaded	Resupply Received PDU
			Number of liters LI' propellant loaded	Resupply Received PDU
			Time started transfer of 2 Copperheads	Event Report PDU
			Rate	
		Average	Total time required to conduct download  Number of sounds downloaded	Event Report PDU  Regionaly Becaused PDI I
		Rate	Number of liters I P propellant downloaded	Position Persived PDI
		2	Type of download (Automated or Manual)	Event Report PDU
			A CONTRACTOR	
		Accuracy of	Actual round count by projectile/fuze	Event Report PDU
		Download	combination	
			System round count	Event Report PDU
Unload (AFAS to Ground). The AFAS	Live or Virtual		Time	
complete rounds (fuzed projectiles and		Median	Time unload finished	Event Report PDU
LP propellant) to a CCL flatrack or the		Unload	Time unload started	Event Report PDU
ground (LP to containers) in less than 45		Time	Number of rounds unloaded	Resupply Received PDU
minutes.			Number of liters LP propellant unloaded	Resupply Received PDU
			Type of unload (Fully Automated, Semi-	Event Report PDU
			Automated or Manual)	
			Number of crew memoers	Event report 1-DO
			Rate	
		Average	Total time required to conduct unload	Event Report PDU
		Unload Rate	Number of rounds unloaded	Resupply Received PDU
			Number of liters LP propellant unloaded	Resupply Received PDU
			Type of unload (Fully Automated, Semi-	Event Report PDU
			Automated of manually	Court Description
			Number of crew members	Even report roo
			Accuracy	
		Accuracy of	Actual round count	Event Report PDU
		Unload	System round count	Event Report PDU

Subject of Experimentation/Testing: AFAS Degraded Operations

Specifications	Environments for	or Measures of	Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs Required to
		Performance	Collection if DIS Virtual Simulation is	Collect Data Elements
	Experimentation		Appropriate Environment	(X = Unsupportable by DIS PDUs)
Manual upload. If the FARV is	Live or Virtual		Time	
unavailable, the AFAS must be capable				
of being manually uploaded with		Median	Time upload finished	Event Report PDU
155mm ammunition and propellant		Time of	Time upload started	Event Report PDU
(from combat configured loads on		Upload	Number of rounds loaded	Resupply Received PDU
palletized loading system trucks or			Number of liters LP propellant loaded	Resupply Received PDU
grounded flatracks) at a median rate of at			Type of upload (Fully Automated, Semi-	Event Report PDU
least one complete round per minute.			Automated or Manual)	
This function includes required			Number of crew members	Event Report PDU
processing of fuzes and projectiles plus				•
data entry (LP lot number (if required)			Rate	
and quantity, quantity of fuel, projectile		Average		
model, projectile lot number, fuzed		Upload Rate	Total time required to conduct upload	Event Report PDU
weight, fuze model and fuze lot.).		•	Number of rounds loaded	Resupply Received PDU
			Number of liters LP propellant loaded	Resupply Received PDU
			Type of upload (Fully Automated, Semi-	Event Report PDU
-			Automated or Manual)	-
			Number of crew members	Event Report PDU
			Accuracy	
		Accuracy of		
		Upload	Actual round count	Event Report PDU
			System round count	Event Report PDU

Subject of Experimentation/Testing: AFAS Degraded Operations

Communications. When conducting	Testino/	Performance	Collection if DIS Virtual Simulation is	Collect Data Floments
Communications. When conducting	Experimentation		Appropriate Environment	(X = Unsupportable by DIS PDUs)
	Live or Virtual		Time	
FARV), the AFAS shall transmit (when		Median	Time docking completed	Signal PDU
downloading) or receive (When		Inventory	Time inventory sent	Signal PDU
uploading) the following information, as		Transmissio	Time inventory received	Signal PDU
applicable: LP lot number (if required)		n Time	Type of resupply operation (upload, download,	Signal PDU
and quantity, quantity of fuel, projectile			exchange, etc.)	•
model, projectile lot number, fuzed			Method of operation (automatic or manual)	Signal PDU
weight, fuze model and fuze lot. If the				
docking link is inoperative, data must be entered manually or with the projectile			Accuracy	
code scanner.		Accuracy of	Quantity of LP propellant reported (Sender)	Signal PDU
		inventory	Actual quantity LP propellant loaded (Receiver)	Event Report PDU
			Record of projectile with fuze by lot, number and	Signal PDU
			Actual number of projectile with fuze by lot,	Event Report PDU
			number and fuzed weight loaded (Receiver)	
			Record of inventory entered if manual entry	Event Report PDU
			Record of inventory if projectile code scanner used	Event Report PDU
			Capability	
If a single failure occurs, the remaining				
radio shall be dedicated to the digital net.			Record of instances where one or both radios	Transmitter and Receiver PDUs
If hook and long fall the beautions chall			Were inoperative	I Co trong to the control of the con
other general with another benefits in			ordinate and when the Arras Operates in a sub-	Eveni Nepoli FDO
a subordinate role if the tactical situation			Record of when the AFAS is out of action due	Event Report PDU
warrants or shall be considered out of			to inoperable radios	•
			Capability	
The AFAS must provide for voice			Record of intrasection voice communications	Signal PDU

Subject of Experimentation/Testing: AFAS Degraded Operations

	Experimentation		Appropriate Environment	(X = Unsupportable by DIS PDUs)
The AFAS crew must be able to	Live or Virtual		Accuracy	
I manually enter data into the ArAs		Accuracy of	Record of data entered manually by type of	Event Report PDU
system including type of projectile, type		Manual Data	projectile and fuze, lot, quantity of propellant and	•
of fuze, lot number of fuze, lot number		Entry	fuzed projectile weight pounds or square weight	
of propellant, lot number of projectile,			Record of actual inventory by type of	Event Report PDU
and tuzed projectite weight.			fuzed projectile weight pounds or square weight	
			Record of operator input errors	Event Report PDU
			Capability	
ine AFAS must be capable of accepting fire commands for manual entry by the crew that are received over the battery			Record of fire missions and commands received over the battery command (voice) net	Signal PDU
command (voice) net.			- E	
		Median		
		transmissio n Time for	Time voice fire mission received Time voice fire mission initiated	Event Report PDU  Byent Report PDU
		Voice Fire Missions		
			Acuracy	
If projectiles are uncoded, then		Accuracy of		1
projectile square weight will be used and		manually	Record of projectile square weight entered Record of system inventory of projectile square	Event Report PDU Event Report PDU
		projectile	weight by projectile	
		square weight		

Subject of Experimentation/Testing: AFAS Degraded Operations

Specifications	Environments for Testing/	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Elements  (X = Unsupportable by DIS PDUs)
Power.	Live or Virtual		Capability	
sufficient power from an external source sufficient power from an external source to enable the AFAS to download ammunition, run diagnostics routines or to start the engine.			Record of engine starts from external power Record of diagnostics run from external power Record of ammunition downloads operations conducted with external power	X (Generally, these data elements are not available in the normal DIS PDU stream. However, they could be made available through custom Event Report PDUs.)
			Capability	
The AFAS must be able to provide sufficient power to another AFAS or a FARV to enable these vehicles to conduct downloading operations, run diagnostic routines or start their engines.			Record of engine starts where AFAS provided external power Record of diagnostics run where AFAS provided external power Record of ammunition downloads operations conducted where AFAS provided external power	X (Generally, these data elements are not available in the normal DIS PDU stream. However, they could be made available through custom Event Report PDUs.)
			Time	
The AFAS must be able to produce a reduced level of power which is capable of powering on-board computer, communications, position/navigation and survivability systems (less main armament and NBC overpressure) and starting the engine for at least 6 hours.		Median Time Reduced Power Level Operations were	Time reduced power level operations stopped Time reduced power level operations initiated Record of reduced power level operations Reason for reduced power level operations	X (Generally, these data elements are not available in the normal DIS PDU stream. However, they could be made available through custom Event Report PDUs.)
Muzzle Velocity. The system must be	Live or Virtual		Capability	
able to accept muzzle velocity variation (MVV) if the on-board system for determining round-to-round variation in muzzle velocity is not available.			Record of MVV input by AFAS Record of MVV input sent to AFAS Reason for MVV input	X (Generally, these data elements are not available in the normal DIS PDU stream. However, they could be made available through custom Event Report PDUs.)
AS	Virtual or Live		Tine	
to operating as a serior of subordinate howitzer, it shall be capable of providing location and orientation data to a		Median Time to	Time last howitzer stopped in firing position Time first howitzer stopped in firing position	Entity State PDU
subordinate howitzer that has lost the capability to provide this data for itself		- 13	Time degraded howitzer was provided location and orientation data	Signal PDO
when the nowitzers are separated by up to 1 km (0.62 mt). Function will be completed by crew members from their		Orientation	Accuracy	
work stations and within two minutes after the howitzers have stopped in their respective firing positions with no more		Average Percent Error in	Surveyed location of degraded howitzer Location provided by senior/subordinate	Event Report or Entity State PDU Signal PDU
than 10 percent degradation in pointing accuracy of the subordinate howitzer.		Azimuth and Location	howitzer to the degraded howitzer Surveyed azimuth Azimuth provided by senior/subordinate howitzer to the degraded howitzer	Event Report or Entity State PDU Signal PDU

Subject of Experimentation/Testing: AFAS Degraded Operations

3.		•	i i	The state of the s
Specifications	Environments for	Measures of	Collection if DIS Victural Simulation is	examily modified of New Dis TUGS Required to
	Experimentation		Appropriate Environment	(X = Unsupportable by DIS PDUs)
Projectile weight. When projectiles in	Live or Virtual		Accuracy	
weighed and coded to the nearest 0.05 kg		Accuracy of	Record of projectile square weight entered	X or Event Report PDU
(0.1 ib), the ArAS shall compute ballistics based on the current square		manually entered data	record of system inventory by square weight by projectile	A of Event Report FDO
method of weighing projectiles.			Capability	
			Record of data computed and fired using the projectile square weight	X or Event Report PDU
Fire Control.	Live or Virtual		Capability	
when the AFAS is operating as a senior or subordinate howitzer, the AFAS shall			Record of tactical fire control data furnished	Signal PDU
be capable of providing tactical and technical fire control for itself and one			Kecord of technical life control data furnished	Signal PDC
subordinate howitzer at the direction of			Distance	
separated by no more than 1 km (0.62		Average Distance	Location of senior/subordinate howitzer	Entity State PDU
aj.		Senior/Sub-	Location of degraded nowitzer	Entity State I'DO
		orginate Howitzer		
		and Degraded Howitzer		
			Capability	
When the AFAS is operating as a senior		Average	December of the first contract of the same	
or subordinate nowitzer, the AFAS shall be capable of accepting factical and		Between	Record of technical fire control data received	Signal PDU
technical fire control data and		Senior/Sub-		
the direction of the POC when the two		Howitzer		
howitzers are separated by no more than		and	Location of senior/subordinate howitzer	Entity State PDU
t with (contribution)		Howitzer	9	
Operations. Under conditions of reduced manning, the APAS must be capable of	Live or Virtual		Time	
performing its primary missions (shoot,		Median Time of	Time reduced manning stopped Time reduced manning started	Event Report PDU Russ Bennet PDI
crew members for limited periods (up to 4		Reduced	Record of fire missions conducted	Signal PDU
hours).		Manning Operations	Record of AFAS movement Record of voice and digital communications	Entity State PDU Signal PDU
			Number of crew members operating system	Event Report PDU

Subject of Experimentation/Testing: AFAS Degraded Operations

	Testing/	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is	Existing, Modified, of New Dis TDUs Required to Collect Data Elements
	Experimentation		Appropriate Environment	(X = Unsupportable by DIS PDUs)
Hydraulic Loss. In the event of loss of hydraulic nower the AFAS must be able to	Live or Virtual		Capability	
manually orient the tube to the proper firing			Record of hydraulic namer loss	X or Event Benort PD[1
azimuth and quadrant to complete the fire			Record of manual data (azimuth and elevation)	X or Event Report PDU
mission.			set to complete fire mission	-
			Record of computed firing data	X or Event Report PDU
Gun Drive Servoe. In the event of loss of	Live or Virtual		Capability	
gun drive servos, the AFAS must be able to				
manually orient the tube to the proper firing			Record of hydraulic power loss	X or Event Report PDU
azimuth and quadrant to complete the fire			Record of manual data (azimuth and elevation)	X or Event Report PDU
mission.			set to complete fire mission  Provid of committed financials	A STATE OF THE STA
			Necota of Computed IIIIIg data	A OF EVERIL NEPORT I DO
Towing.	Live or Virtual			
The APAS shall be capable of being towed in		Median		
the forward direction by the M88A1, a FARV,		Time for	Time towing stopped	X or Event Report PDU
or another AFAS, without using a "hold		Towing	Time towing started	X or Event Report PDU
back" vehicle. The system shall be capable of		Operations	•	
towing a FARV or an AFAS at forward		· <del></del>	Distance	
speeds of at least 20 km per hour for at least	•	Average		
15 km on a dry, level, hard surface, with no		Straight	Location towing stopped	X or Event Report PDU
damage to either the towing vehicle or the		Line Towing	Location towing started	X or Event Report PDU
vehicle being towed. The system shall		Distance	•	•
require no special preparation prior to				
towing (e.g., disconnection of final drives).		Average	Odometer reading when towing completed	X or Event Report PDU
		Distance	Odometer reading when towing started	X or Event Report PDU
		traveled		
		Towing		
		Operations	Capability:	
The AFAS must be able to be towed and			Record of recovery by vehicle model (M88A1.	X or Event Report PDU
recovered by organic recovery assets (projected to be the M88A1).			AFAS, FARV, etc.)	

## Subject of Experimentation/Testing: AFAS Degraded Operations

operations including unpowered download, manual upload and unload operations and workload task analysis. Evaluation of manual tasks and degraded operations could assess the 2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment. Based on the results derived from the above matrix, DIS experimentation/testing appears alternative power sources and varying degrees of robotics that have potential application to improve howitzer vehicle combat operations, maintainability and sustainment.
Demonstrate the suitability of the new technologies being applied to the AFAS (automation, advanced propellant handling, ammunition management, and ammunition transfer impact of the AFAS's ability and the crew's ability to conduct sustained battlefield operations. Experiments could evaluate selection and development of technologies including Environment would allow demonstration of key specifications and requirements related to manual and degraded operations. It would permit evaluation of degraded resupply feasible to assess the operational and technical tradeoffs in the following AFAS stated specifications and other aspects of performance derived by the analysis: A DIS Virtual

#### 2.1 Stated specifications:

- Unpowered Download Rate (AFAS to FARV)
- Manual Unload Rate (AFAS to Ground)
  - Manual Upload Rate (PLS to AFAS)
    - Communications
      - Manual Data Entry
      - Power
- Position and Location
- Operations
  - Hydraulic Loss
    - Towing

# 2.2 : Other Aspects of Performance Measurable in a DIS Virtual Environment. None

appropriate to the AFAS System Threat Assessment Report (STAR) and at combat tempo in accordance with the approved Operational Mode Summary/Mission Profile (OMS/MP). For example changes can be measured in terms of the battle outcomes at the conclusion of the experiment/scenario. Listed below are example battle statistics and conclusions that testers/analysis may derive 2.3 Sample Experiment. A single experiment/scenario in the DIS virtual environment can address each of the specifications and other aspects of performance outlined above. Analysts Placing the AFAS simulator on a combined arms virtual battlefield may not permit validations of some aspects as specified in the AFAS specification. However, the overall impact of design if the AFAS simulator software has a manual download, unload and upload capability, the impact on overall system and crew capability to meet battlefield requirements may be determined. the experiment repeatedly altering system capabilities. The experiments should be run against approved Training and Doctrine Command (TRADOC) according from the data elements in the above matrix to correlate experiment results to design changes:

- Median manual download, unload and upload times
- Average manual download, unload and upload rates
- Accuracy of inventories conducted during manual or degraded operations
- Number and quality of manual data entries and inventories
- Number of intrasection communications
- Number of digital communications conducted
- Number of resupply operations completed by each AFAS
- Number of resupply trips to the LRP completed by each AFAS when FARV is unavailable
  - Number of missions not fired due to ammunition, fuel or LP propellant shortages
    - Number of projectiles fired by type
- Number of entries where projectile square weight was entered
- Number of instances where external power was required to conduct ammunition download operations, run diagnostics and conduct engine starts
- Amount of time system was operated at a reduced power level
- Number of instances where loss of hydraulics resulted in manual operations being conducted Amount of time system was operated at reduced manning levels
  - Number and distance traveled for towing operations
- Number of instances where the AFAS towed another vehicle

## Subject of Experimentation/Testing: AFAS Degraded Operations

- 3. Required Resources. To support experimentation and testing in the areas identified above the following resources are required:
- One AFAS crew to man an AFAS simulator
- One AFATDS POC computer to process the observer's call for fire, update information bases on fire support coordination measures, battlefield geometry, meteorological data, and One AFAS simulator equipped with BCC, radios, modems, crew stations, crew displays and supporting software to conduct fire missions.
  One observer to acquire and submit calls for fire to engage opposition force targets on the virtual battlefield.
  One fire direction computer operator
  - preplanned targets.

    One AFAS SAFOR to support degraded power operations, docking, towing and resupply operations
    Several PLS CCL Flatracks in various configurations (full, partial and empty) to support resupply operations.

    - One SAFOR fuel truck to support LRP refueling operations
      One M88A1 SAFOR for towing operations
      One FARV SAFOR to support LRP, paired operations, docking, resupply and towing operations

      - Threat SAFOR operations order Threat SAFOR to execute the order
- Friendly force operations order with fire support coordination measures and battlefield geometry Friendly SAFOR to execute the order

Subject of Experimentation/Testing: FARV Degraded Operations

Specifications	Environments for Testing/	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Elements  (X = Unsupportable by DIS PDUs)
Download (AFAS to FARV). When required for maintenance or other	Live or Virtual		Time	
operational reasons, fuzed projectiles and liquid propellant shall be capable of		Median Download	Time when the FARV is again capable of.	Event Report PDU
being manually downloaded at a rate of		Time	Time when the system initiates a maneuver	Event Report PDU
at reast 150 complete founds in less trials 90 minutes with the system in an			Number of rounds loaded	Resupply Received PDU
unpowered state.			Number of liters LP propellant loaded	Resupply Received PDU
			Time started transfer of 2 Copperheads  Time started transfer of 2 Copperheads	Event Report PDU
			Rate	
		Average	Total time required to conduct download	Event Report PDU
		Download Rate	Number of rounds downloaded Number of liters LP propellant downloaded	Resupply Received PDU Resupply Received PDU
			lype of download (Automated or Manual)	Event Report PDU
			Accuracy	
		Accuracy of	Actual round count by projectile/fuze	Event Report PDU
		DBOILLAGO	System round count	Event Report PDU
Unload (FARV to Ground). The FARV crew must be able to manually unload	Live and Virtual		Time	
130 complete rounds (fuzed projectiles		Median	Time unload finished	Event Report PDU
and LP propellant) to a CCL flatrack or the propellant to containers) in less		Unioad	Time unload started Number of rounds unloaded	Event Report PDU Remonsty Received PDU
than 90 minutes.	,	,	Number of liters LP propellant unloaded	Resupply Received PDU
			Type of unload (Fully Automated, Semi-	Event Report PDU
			Number of crew members	Event Report PDU
			Rate	
		Average	Total time required to conduct unload	Event Report PDU
		Onioad Nate	Number of fourth unloaded  Number of liters LP propellant unloaded	Resupply Received PDU
			Type of unload (Fully Automated, Semi-Automated or Manual)	Event Report PDU
			Number of crew members	Event Report PDU
			Accuracy	
		Accuracy of Unload	Actual round count System round count	Event Report PDU Event Report PDU

Subject of Experimentation/Testing: FARV Degraded Operations

Specifications	Environments for Testing/	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing. Modified, or New DIS PDUs Required to Collect Data Elements (X = Unsupportable by DIS PDUs)
Manual upload. The FARV must be capable of being manually uploaded with	Live and Virtual		Time	
155mm ammunition and propellant		Median	Time upload finished	Event Report PDU
palletized loading system trucks or		Upload	Number of rounds loaded	Resupply Received PDU
grounded flatracks) at a median rate of at		•	Number of liters LP propellant loaded	Resupply Received PDU
least one complete round per minute. This function includes required			Type of upload (Fully Automated, Semi- Automated or Manual)	Event Report PDU
processing of fuzes and projectiles plus			Number of crew members	Event Report PDU
data entry (Li' lot number (if required) and quantity, quantity of fuel, projectile			Rate	
weight, fuze model and fuze lot.). If		Average	Total time required to conduct upload	Event Report PDU
projectiles are uncoded, then projectile		Upload Rate	Number of from 1 B proposition loaded	Resupply Received PDU
שלחפו כ אכופני אייו חב חשבתי			Type of pload (Fully Automated, Semi-	Event Report PDU
			Number of crew members	Event Report PDU
			Accuracy	
		Accuracy of	Actual round count	Event Report PDU
		Upload	System round count	Event Report PDU

Subject of Experimentation/Testing: FARV Degraded Operations

Specifications	Environments for Testing/ Experimentation	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Elements (X = Unsupportable by DIS PDUs)
Communications. When conducting resupply operations (Manual and with another FARV or AFAS), the FARV shall transmit (when downloading) or receive (when uploading) the following information, as applicable: LP lot number (if required) and quantity,	Live and Virtual	Median Inventory Transmissio n Time	Time docking completed Time inventory sent Time inventory received Type of resupply operation (upload, download, exchange, etc.)	Signal PDU Signal PDU Signal PDU Signal PDU
quantity of fuel, projectile model, projectile lot number, fuzed weight, fuze model and fuze lot.			Method of operation (automatic or manual) Accuracy	Signal PDU
		Accuracy of inventory	Quantity of LP propellant reported (Sender) Actual quantity LP propellant loaded (Receiver) Record of projectile with fuze by lot, number and fuzed weight reported (Sender)	Signal PDU Event Report PDU Signal PDU
			Actual number of projectile with fuze by lot, number and fuzed weight loaded (Receiver) Record of inventory entered if manual entry	Event Report PDU Event Report PDU
			Record of inventory if projectile code scanner used	Event Report PDU
If a single failure occurs, the remaining radio shall be dedicated to the digital net.			Record of instances where one or both radios	Transmitter PDU and Receiver PDU
If both radios fail, the howitzer shall either uperate with another howitzer in		, "	record of when the AFAS operates in a sub- ordinate role when radios are inoperative	Event Report PDU
a subordinate role if the factical situation warrants or shall be considered out of action.			Record of when the AFAS is out of action due to inoperable radios	Event Report PDU
The AFAS must provide for voice communications between crew stations.			Record of intrasection voice communications	Signal PDU

Subject of Experimentation/Testing: FARV Degraded Operations

Specifications	Environments for Testing/	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Anoromiate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Elements
Manual Data Entry.	Live and Virtual		Accuracy	
I've FARY crew must be able to manually enter data into the FARV system including type of projectile, type		Accuracy of Manual Data	Record of data entered manually by type of projectile and fuze, lot, quantity of propellant and	Event Report PDU
of fuze, lot number of fuze, lot number of propellant, lot number of projectile, and fuzed projectile weight (by square weight and by pound).		Entry	fuzed projectile weight pounds or square weight Record of actual inventory by type of projectile and fuze, lot, quantity of propellant and fuzed projectile weight pounds or square weight	Event Report PDU
			Capability	
			Record of fire missions and commands received over the battery command (voice) net	Signal PDU
			Time	
	****	Median transmissio n Time for Voice Fire	Time voice fire mission received Time voice fire mission initlated	Event Report PDU Event Report PDU
		Missions	Accuracy	
If projectiles are uncoded, then projectile square weight will be used and entered manually into the system.		Accuracy of manually entered projectile	Record of projectile square weight entered Record of system inventory of projectile square weight by projectile	Event Report PDU  Event Report PDU
		square weight		

Subject of Experimentation/Testing: FARV Degraded Operations

Specifications	Environments for		Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs Required to
	Experimentation	remormance	Appropriate Environment	Collect Data Elements (X = Unsupportable by DIS PDUs)
Power. The EARV must be able to accent	Live and Virtual		Capability	
sufficient power from an external source		<del>-</del>	Record of engine starts from external power	X (Generally, these data elements are not available in the normal DIS DINI stream Linguistics
ammunition, run diagnostics routines			Record of ammunition downloads operations	they could be made available through custom
or to start the engine.			conducted with external power	Event Report l'Dus.)
			Capability	
The FARV must be able to provide			Record of engine starts where FARV provided	X (Generally, these data elements are not avail-
FARV to enable these vehicles to			Record of diagnostics run where FARV provided	they could be made available through custom
conduct downloading operations, run diagnostic routines or start their engines.			external power Record of ammunition downloads operations conducted where FARV provided external nower	Event Report PDUs.)
i i			Time bound of the	
The FARV must be able to produce a reduced level of power which is capable			lime	
of powering on-board computer,		Median	Time reduced power level operations stopped	X (Generally, these data elements are not avail-
communications, position/navigation		Time	Time reduced power level operations initiated	able in the normal DIS PDU stream. However,
armament and NBC overpressure) and		Power Level	Reason for reduced power level operations	Event Report PDUs )
starting the engine for at least 6 hours.		Operations		•
-		were Conducted		
Position. The FARV shall be capable of	Live and Virtual		Time	
providing location data to another				
FARY that has lost the capability to provide this data for itself when the		Median Time to	Time last vehicle stopped in position Time first vehicle stopped in position	Entity State PDU
FARVs are separated by up to 1 km (0.62		Provide	Time degraded FARV was provided location data	Signal PDU
mi). Function will be completed by crew		Location and	-	
members from their work stations and		Orientation		
have stopped in their respective		Cata	Accuracy	
positions.		Average	Surveyed location of degraded FARV	Event Reported PDU or Entity State PDU
		Percent Early in	Location provided by FARV	Signal PDU
		Azimuth		
Operations. Under conditions of reduced	Live and Virtual	and Extension	Time	
manning, the FARV must be capable of		1		
performing its primary missions (resupply, move, communicate, and survive) with two		Median Time of	Time reduced manning stopped Time reduced manning started	Event Report PDU
crew members for limited periods (up to 4		Reduced	Record of resupply missions conducted	Signal PDU
hours).		Manning Operations	Record of rank movement Record of voice and digital communications	Entry State 1'DU Signal PDU
			Number of crew members operating system	Event Report PDU

Subject of Experimentation/Testing: FARV Degraded Operations

Specifications	Environments for Testing/	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is	Existing, Modiffed, or New DIS PDUs Required to Collect Data Elements
	Experimentation		Appropriate Environment	(X = Unsupportable by DIS PDUs)
Hydraulic Loss. In the event of loss of	Live and Virtual		Capability	
hydraulic power, the FARV must be able to				
manually operate critical system functions to			Record of hydraulic power loss	X or Event Report PDU
complete the mission.			Record of mission complete using manual	X or Event Report PDU
			operation	
Towing.	Live and Virtual		Time	
The FARV shall be capable of being towed in		Median		
the forward direction by the M88A1, a FARV,		Time for	Time towing stopped	X or Event Report PDU
or an AFAS, without using a "hold back"		Towing	Time towing started	X or Event Report PDU
vehicle. The system shall be capable of		Operations	•	
towing a FARV or an AFAS at forward		•	Distance	
speeds of at least 20 km per hour for at least		Average		
15 km on a dry, level, hard surface, with no		Straight	Location towing stopped	X or Event Report PDU
damage to either the towing vehicle or the		Line Towing	Location towing started	X or Event Report PDU
vehicle being towed. The system shall		Distance	•	
require no special preparation prior to				
towing (e.g., disconnection of final drives).		Average	Odometer reading when towing completed	X or Event Report PDU
		Distance	Odometer reading when towing started	X or Event Report PDU
		traveled		
		Towing		
		Operations		
			Capability	
The FARV must be able to be towed and			Record of recovery by vehicle model (M88A1.	X or Event Report PDI
recovered by organic recovery assets			AFAS, FARV, etc.)	
(projected to be the moons).				

## Subject of Experimentation/Testing: FARV Degraded Operations

operations including unpowered download, manual upload and unload operations and workload task analysis. Evaluation of manual tasks and degraded operations could assess the impact of the PARV's ability and the crew's ability to conduct sustained battlefield operations. Evaluate selection and development of technologies including alternative power sources and varying degrees of robotics. Demonstrate the suitability of the new technologies being applied to the FARV (automation, advanced propellant handling, ammunition 2. Technical and Operationa: Benefits of Experimentation in DIS Virtual Environment. Based on the results derived from the above matrix, DIS experimentation/testing appears Environment would allow demonstration of key specifications and requirements related to manual and degraded operations. It would permit evaluation of degraded resupply reasible to assess the operational and technical tradeoffs in the following FARV stated specifications and other aspects of performance derived by the analysis: A DIS Virtual management, and ammunition transfer and docking)

#### 2.1 Stated specifications:

- Unpowered Download Rate (AFAS to FARV)
  - Manual Unload Rate (FARV to Ground)
    - Manual Upload Rate (PLS to FARV)
      - Communications
- Manual Data Entry
- Power
- Operations Position
- Hydraulic Loss

# 2.2 : Other Aspects of Performance Measurable in a DIS Virtual Environment. None

2.3 Sample Experiment, A single experiment scenario in the LDS vinual circumstances. The experiments should be run against approved Training and Doctrine Command (TRADOC) acenarios and testers can run the same experiment repeatedly altering system capabilities. The experiments should be run against approved Operational Mode Summary/Mission Profile (OMS/MP). For example appropriate to the FARV System Threat Assessment Report (STAR) and at combat tempo in accordance with the approved Operational Mode Summary/Mission Profile (OMS/MP). For example parties to the FARV System and crew capability the impact on overall system and crew capability to meet battle field requirements may be determined. Placing the AFAS simulator on a combined arms virtual battlefield may not permit validations of some aspects as specified in the FARV specification. However, the overall impact of design changes can be measured in terms of the battle outcomes at the conclusion of the experiment/scenario. Listed below are example battle statistics and conclusions that testers/analysts may derive 2.3 Sample Experiment. A single experiment/scenario in the DIS virtual environment can address each of the specifications and other aspects of performance outlined above. Analysts

- Median manual download, unload and upload times
- Average manual download, unload and upload rates
- Accuracy of inventories conducted during manual or degraded operations
  - Number and quality of manual data entries and inventories
    - Number of intrasection communications
- Number of digital communications conducted
- Number of resupply operations completed by each FARV
- Number of missions not fired due to ammunition, fuel or LP propellant shortages Number of resupply trips to the LRP completed by each FARV
  - Number of projectiles fired by type
- Number of entries where projectile square weight was entered
- Number of instances where external power was required to conduct ammunition download operations, run diagnostics and conduct engine starts
  - Amount of time system was operated at a reduced power level
- Amount of time system was operated at reduced manning levels
- Number of instances where loss of hydraulics resulted in manual operations being conducted
  - Number and distance traveled for towing operations
- Number of instances where the FARV towed another vehicle

## Subject of Experimentation/Testing: FARV Degraded Operations

- 3. Required Resources. To support experimentation and testing in the areas identified above the following resources are required:
- One FARV crew to man an FARV simulator
- One FARV simulator equipped with radios, modems, crew stations, crew displays and supporting software. One observer to acquire and submit calls for fire to engage opposition force targets on the virtual battlefield.
- One AFATDS POC computer to process the observer's call for fire, update information bases on fire support coordination measures, battlefield geometry, meteorological data, and preplanned largets.

  One AFAS simulator equipped with BCC, radios, modems, crew stations, crew displays and supporting software to conduct fire missions.

  One AFAS SAFOR to support degraded power operations, docking, towing and resupply operations.

  Several PLS CCL Flatracks in various configurations (full, partial and empty) to support resupply operations.

  One SAFOR fuel truck to support LRP refueling operations

  One M88A1 SAFOR for towing operations

  One FARV SAFOR to support LRP, paired operations, docking, resupply and towing operations One fire direction computer operator
- - Threat SAFOR operations order
- Threat SAFOR to execute the order Friendly force operations order with fire support coordination measures and battlefield geometry Friendly SAFOR to execute the order

Subject of Experimentation/Testing. AFAS Crew Size and Military Occupational Specialty (MOS)

Specifications	Environments for Testing/Experimentation	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Hements (X = Unsupportable by DIS PDUs)
Personnel. The system shall be operated by a	AFAS simulator	Mission	Time	
three man crew. It is expected that each crew member will possess a 13B MOS code.	equipped with BCC, radios, modem,	response time for moving or	Time vehicle stops in firing position	Entity State PDU
	intercom, and crew station displays	emplaced AFAS	Time fire mission acknowledged by BCC	Event Report PDU
			Time first round fired	Fire PDU
		Number of missions and	Mission Fired Reports (MFR) transmitted by AFAS to POC	Event Report PDUs to designate each MFR transmitted
		projectiles fired	Projectile type and number fired	Fire and Detonation PDUs
			Crew warning enunciators activated	Event Report PDU
		Detection and	Location	
		warning of violations of fire support	Location of fire support coordination measures and battlefield geometry	Signal PDU
		measures and	Location of target in call for fire	Detonation PDU
		battlefield	Location of AFAS howitzer	Fire PDU
		geometry.	Location of projectile trajectory (x,y,z axes)	Entity State PDU
		Outcome of	Effects on Target	
		engagements	Vehicle and force identification	Detonation PDU
			Mobility kills	Entity State PDU
			Fire control kills	Entity State PDU
			Communication kills	Receiver PDU
			Area visually obscured	Entity State PDU
			Area illuminated	Suggest extension of DIS standards to allow representing illumination as an environmental entity, much like a smoke cloud is handled now.

Subject of Experimentation/Testing. AFAS Crew Size

	Experiments for Testing/	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modiffed, or New DIS PDUs Required to Collect Data Elements (X = Unsupportable by DIS PDUs)
Reduced Crew. The system shall provide the	AFAS simulator	Mission	Time	
capability for conducing its primary functions (shoot, move, communicate, and survive)	equipped with DCC, radios, modem, intercon	for moving or	Time crew reduced from 3 to 2 crew members	X (Manual Entry)
with two trew interports for up to a fronts with no degradation in performance.	station displays	AFAS	Time vehicle stops in firing position	Entity State PDU
			Time fire mission acknowledged by BCC	Event Report PDU
		Number of	Time first round fired	Fire PDU
		missions and projectiles fired	Mission Fired Reports (MFR) transmitted by AFAS to POC	Event Report PDUs to designate each MFR transmitted
			Projectile type and number fired	Fire and Detonation PDUs
		Detection and	Crew warning enunciators activated	Event Report PDU
		warning of violations of	Location	
		nre support coordination measures and	Location of fire support coordination measures and battlefield geometry	Signal PDU
		rriendly battlefield	Location of target in call for fire	Detonation PDU
		geometry.	Location of AFAS howitzer	Fire PDU
		Outcome of	Location of projectile trajectory (x,y,z axes)	Entity State PDU
		engagements	Effects on Target	
			Vehicle and force identification	Detonation PDU
			Mobility kills	Entity State PDU
			Fire control kills	Entity State PDU
			Communication kills	Receiver PDU
			Area visually obscured	Entity State PDU
			Area illuminated	Suggest extension of DiS standards to allow representing illumination as an environmental entity, much like a smoke cloud is handled now.

2 2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment. DIS experimentation and testing appears feasible to assess the operational and technical tradeoffs involved in varying AFAS crew size. Listed below are example battle statistics that testers/analysts may derive from the data elements in the above matrix to correlate experiment results changes in crew size:

- Number of threat entities sustaining combat damage by AFAS indirect fire by projectile type
- Number of threat entities blinded by AFAS smoke
- Number of threat entities illuminated by AFAS illumination missions
- Number of AFASs and FARVs sustaining combat damage
- Number and type of missions fired (i.e. standard, MRSI, Copperhead)
- Number of projectiles fired by type
- Number of fratricides resulting from violation of fire support coordination measures and battlefield geometry
- Mission response time by mission for AFAS while emplaced
- Mission response time by mission for AFAS while moving

and system survivability, threat entity kills, fratricides, and number of missions fired by type. Installation of an actual C<sup>3</sup> Subsystem prototype in the AFAS simulator provides the opportunity to experiment with various hardware and software design architectures and crew configurations to determine the best fit to meet overall response times for any specified crew level. Experiments/scenarios in the DIS virtual environment could determine operational and technical tradeoffs offered by alternative manning levels, task loading, crew station configurations, and soldier-machine interfaces (SMIs). The primary area under examination will be crew response time under varying mission loads, however, there may be some correlations between crew size В

- 3. Required Resources. To support experimentation and testing in the areas identified above the following resources are required:
- · One AFAS crew to man an AFAS simulator
- One AFAS simulator equipped with prototype C3 Subsystem complete with BCC, radios, modems, crew stations, crew displays, supporting software, and access to M712 Copperhead rounds in the ammunition storage area.
- One FARV simulator and crew or FARV SAFOR and SAFOR controller to support resupply operations. Fire Support Automated Test System (FSATS) could be upgraded to support digital messaging from a SAFOR FARV to an AFAS manned simulator during docking operations to coordinate and control ammunition and fuel transfer.
- One LRP SAFOR and LRP controller to support FARV upload/download operations.
- One observer to acquire and submit calls for fire to engage opposition force targets on the virtual battlefield. FSATS could be employed as an alternative to generate calls for fire that drive a highly controlled scenario.
- One AFATDS POC computer operator to process the observer's call for fire. Another alternative is to upgrade PSATS POC node so that the PSATS POC may interface with AFAS and FARV Texers. Testers could then embed the scenario in PSATS and allow the AFAS and FARV crews to interact with FSATS message traffic generated by the POC or observer nodes as
- Threat SAFOR operations order and controller to execute order.
- Friendly force operations order with fire support coordination measures and battlefield geometry and controller to execute order.

Subject of Experimentation/Teeting. FARV Crew Size and Military Occupational Specialtly (MOS)

Specifications	Environments for	Measures of	Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs
	Testing/ Experimentation	Performance	Collection if DIS Virtual Simulation is Appropriate Environment	Required to Collect Data Elements (X = Unaupportable by DIS PDUs)
Penonnel. The system shall be operated by a	FARV simulator	Number of	Number of fire a. issions fired	
three man crew. It is expected that each crew member will possess a 138 MOS.	equipped with C3 Subsystem complete	missions and projectiles	Mission Fired Reports (MFR) transmitted by	Event Report PDUs to designate each
	with radios,	fired	AFAS to POC	MFR transmitted
	station displays and		Projectile type and number fired	Fire and Detonation PDUs
		Number of	Vehicles sustaining combat damage	
		friendly losses	Number of AFASs	Entity State PDU
			Number of FARVs	Entity State PDU
			Number and type of threat entities	Entity State PDU
		Number of	Time	
		ArAS resupply	Time resupply requests acknowledged by FARV	Signal PDU
		directly to the	Time resupply completed by FARV	Event Report PDU
		raky and time to complete	Number of AFAS resupply requests sent directly to FARV	
		resuppiy.	Message type = resupply	Signal PDU
			Message sender	Transmitter PDU
		)	Message receiver	Receiver PDU
		AFAS	Time acknowledged	Signal PDU
		resupply requests sent	Time resupply completed	Event Report PDU
		and time to	Number of AFAS resupply requests sent to POC	
		resupply.	Message type = resupply	Signal PDU
			Message sender	Transmitter PDU
			Message receiver	Receiver PDU
	·		Time received and acknowledged	Signal PDU
			Time resupply completed	Event Report PDU

Subject of Experimentation/Testing. FARV Crew Size

Specifications	Environments for Testing	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate	Existing, Modified, or New DIS PDUs Required to Collect Data Elements
	Experimentation		Environment	(X = Unsupportable by DIS PDUs)
Reduced Crew. The system shall provide the canability for conducting its primary functions	FAKV simulator	Number of missions and	Number of fire missions fired	
(resupply, move, communicate, and survive)	Subsystem complete		Mission Fired Reports (MFR) transmitted by	Event Report PDUs to designate each
with two crew members for up to 4 hours with	with radios,	jued Juried	AFAS to POC	MFR transmitted
	station displays and		Projectile type and number fired	Fire and Detonation PDUs
	decison aids.	Number of	Vehicles sustaining combat damage	
		threat and friendly losses	Number of AFASs	Entiry State PDU
			Number of FARVs	Hottiv State PD()
			Number and type of threat entities	Entity State PDU
		Number of	Time	
		resupply	Time resupply requests acknowledged by FARV	Signal PDU
		directly to the	Time resupply completed by FARV	Event Report PDU
		time to	Time crew reduced from 3 to 2 crew members	X (Manual Entry)
		complete resupply.	Number of AFAS resupply requests sent directly to FARV	
			Message type = resupply	Signal PDU
			Message sender	Transmitter PDU
		APAS	Message receiver	Receiver PDU
		requests sent	Time acknowledged	Signal PDU
		and time to	Time resupply completed	Event Report PDU
		resupply.	Number of AFAS resupply requests sent to POC	
			Message type = resupply	Signal PDU
			Message sender	Transmitter PDU
			Message receiver	Receiver PDU
			Time received and acknowledged	Signal PDU
			Time resupply completed	Event Report PDU

#### Subject of Experimentation/Testing. FARV Crew Size

- 2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment. DIS experimentation and testing appears feasible to assess the operational and technical tradeoffs involved in varying AFAS crew size. Listed below are example battle statistics that testers/analysts may derive from the data elements in the above matrix to correlate experiment results to
- Number and type of missions fired (i.e., standard, MRSI, Copperhead)
- Number of projectiles fired by type
- Number of AFASs and FARVs sustaining combat damage
- Resupply response time by resupply request by control mode (centralized or decentralized)

and system survivability and the number of projectiles and missions fired. Installation of an actual C<sup>3</sup> Subsystem prototype in the FARV simulator provides the opportunity to experiment with various system and software design architectures and crew configurations to determine the best fit to meet overall resupply response times for any specified crew level. Experiments/scenarios in the DIS virtual environment could determine operational and technical tradeoffs offered by alternative manning levels, task loading, crew station configurations, and soldier-machine interfaces (SMIs). The primary area under examination will be crew response time under varying mission loads, however, there may be some correlations between crew size

- To support experimentation and testing in the areas identified above the following resources are required: 3. Required Resources.
- One AFAS crew to man an AFAS simulator
- One AFAS simulator equipped with prototype C3 Subsystem complete with BCC, radios, modems, crew stations, crew displays, supporting software, and access to M712 Copperhead rounds in the ammunition storage area.
- One FARV simulator and crew or FARV SAFOR and SAFOR controller to support resupply operations. Fire Support Automated Test System (PSATS) could be upgraded to support digital messaging from a SAFOR FARV to an AFAS manued simulator during docking operations to coordinate and control ammunition and
- One LRP SAFOR and LRP controller to support FARV upload/download operations.
- One observer to acquire and submit calls for fire to engage opposition force targets on the virtual battlefield. FSATS could be employed as an alternative to generate calls for fire that drive a highly controlled scenario.
- One AFATDS POC computer operator to process the observer's call for fire. Another alternative is to upgrade PSATS POC node so that the PSATS POC may interface with AFAS and FARV. Testers could then embed the scenario in PSATS and allow the AFAS and FARV crews to interact with PSATS message traffic generated by
- Threat SAFOR operations order and controller to execute order.
- Friendly force operations order with fire support coordination measures and battlefield geometry and controller to execute order.

Subject of Experimentation/Testing: AFAS Crew MOPP Levels
1. Data Collection Requirements

	Environments for Testing/ Experimentation	Messures of Performance	Characteristics and Their Dea Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified or New DIS PDUs Required to Collect Data Blements (X-Unsupportable by DIS PDUs)
MOPP 4 Conditions. The system shall be operable and maintainable by crew members while wearing Mission Oriented Protective Posture (MOPP) 4 and other environmental protective clothing. The use of MOPP 4 clothing by the crew indicates either a requirement for operations outside the crew compartment, or that the NBC defensive system that protects the crew is not operational. This NBC defensive system detects presence of all known NBC contaminants and includes NBC detection, warning, filtration and environmental conditioning systems.	Virtual or Live	Time Accuracy	All data elements related to crew operations and system maintenance operations and system maintenance time and accuracy for all experiment variables elsewhere in this study, e.g., this study. No new DIS PDUs must crew times to conduct a Copperhead be defined.  clothing on.	All DIS PDUs defined for other crew operations and system maintenance experiment variables elsewhere in this study. No new DIS PDUs must be defined.
Training. Crew training level can be evaluated Virtual or Live by tracking individual speed and accuracy in executing the commands and other functions		Time Accuracy	Time Command execution speeds	×
maintenance of the AFAS, with and without MOPP 4 clothing on. Accuracy is a function of executing the commands in the proper sequence.		i	Accuracy Correct operational sequencing	×

### Subject of Experimentation/Testing: AFAS Crew MOPP Levels

- 2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment. Planners can derive both technical and operational data about performance degradation caused by Gwearing a cumbersome, uncomfortable and stress producing set of protective gear. Across an extended period of operations, the wearing of MOPP 4 gear will degrade mental alertness and induce physical fatigue and discomiort, thereby raising stress levels. The combined effect should be sharply defined for all data elements associated with crew operations and maintenance defined for supporting the experiment variable in this study. The AFAS specification does not address any MOPP level other than MOPP 4, which involves the wearing of the full suit, properly sealed, with Agives and protective mask—the only condition that seriously impairs crew performance.

  3. Required Resources. DIS PDUs that capture crew performance degradation in the conduct of both operational and technical tasks listed for all other experiment variables in this study.

Subject of Experimentation/Testing: FARV Crew MOPP Levels
1. Data Collection Requirements

Characteristics and Their Data Etieting, Modified or New DIS PDUs Elements for Collection if DIS Required to Collect Data Elements Virtual Simulation is Appropriate (X=Uneupportable by DIS PDUs) Environment	All DIS PDUs defined for other crew operations and system maintenance time and accuracy for all experiment variable listed in this study, e.g., crew times to conduct a Copperhead mission, with and without MOPP 4 clothing on.	Time
Virtual Simula	All data element operations and s time and accurac variable listed in crew times to co mission, with an clothing on.	Time
Measures of Performance	Time Accuracy	Time Accuracy
Environments for Testing/ Experimentation	Virtual or Live	Live
Specifications	MOPP 4 Conditions. The system shall be operable and maintainable by crew members while wearing Mission Oriented Protective Posture (MOPP) 4 and other environmental protective clothing. The use of MOPP 4 clothing by the crew indicates either a requirement for operations outside the crew compartment, or that the NBC defensive system that protects the crew is not operational. This NBC defensive system operational. This NBC defensive system detects presence of all known NBC detection, warning, filtration and environmental conditioning systems.	Training. Crew training level can be evaluated Virtual or by tracking individual speed and accuracy in

### Subject of Experimentation/Testing: FARV Crew MOPP Levels

- 4. Technical and Operational Benefits of Experimentation in DIS Virtual Environment. Planners can derive both technical and operational data about performance degradation caused by wearing a cumbersome, uncomfortable and stress producing set of protective gear. Across an extended period of operations, the wearing of MOPP 4 gear will degrade mental alertness and induce physical fatigue and discomfort, thereby raising stress levels. The combined effect should be sharply defined for all data elements associated with crew operations and maintenance defined for every other experiment variable in this study. The FARV specification does not address any MOPP level other than MOPP 4, which involves the wearing of the full suit, properly sealed, with gloves and protective mask—the only condition that seriously impairs crew performance.
  - Required Resources. DIS PDUs that capture crew performance degradation in the conduct of both operational and technical tasks listed for all other experiment variables in this study.

Subject of Experimentation/Testing: AFAS Crew Positions

1. Data Collection Requirements

Specifications	Environments for Testing/	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Edisting, Modified, or New DIS PDUs Required to Collect Data Beneals (X = Insupportable by DIS PDUs)
Crew Positions		Can crew members perform their assigned tasks (TBD) within the specified time limits from their assigned crew positions.	Under normal operating conditions:  Time required task initiated.  Specified time to complete task.  Under degraded operating conditions:  Time required task initiated.  Time required task complete d.	X(1).
Intervisibility	SIL, Virtual	intervisibility required for safe operation of the vehicle and performance of tasks and missions.		X(1).
Between Crew Members	SIL, Virtual	Does having face-to-face intravisibility between crew members enhance mission accomplishme nt or does not having face-intravisibility degrade mission accomplishme nt.	Time tasks (TBD) requiring crew coordination begin.  Time tasks requiring crew coordination end.  Increase or decrease in efficiency due to crew intervisibility	X(1).

Subject of Experimentation/Testing: AFAS Crew Positions

Establish base What conditions require full face to face capability. K(1).  Intercom working and not.  and crew lasks at one hour remains and crew lasks at one hour with face to face capability.  Establish base What conditions require full face to face capability.  Time to accomplish tasks without intercom and with face to face capability.  Time to accomplish tasks without intercom and with face to face capability.  Time to accomplish tasks without intercom and with face to face capability.  Time to accomplish tasks without intercom and without face to face capability.  Time to accomplish tasks without intercom and without face to face capability.  Time to accomplish tasks without intercom and without face to face capability.  Intercom working or not.  Intercom working or not.  And crew lasks  At one hour  Intercom working to not.  Apparial  Visibility capability.  Time to accomplish tasks without intercom and with face to face capability.  Determine  capabilities.  Time to accomplish tasks without intercom and with face to face capability.  Time to accomplish tasks without intercom and with face to face capability.  Time to accomplish tasks without intercom and without face to face capability.  Time to accomplish tasks without intercom and without face to face capability.  Time to accomplish tasks without intercom and without face to face capability.  Time to accomplish tasks without intercom and without face to face capability.	Environments for Testing
Establish base What conditions require full face to face capability indetines for individuals at one hour intervals over a period of 48 hours with face to face capability.  Time to accomplish TBD tasks with face to face capability.  Time to accomplish tasks without intercom and with face to face capability.  Time to accomplish tasks without intercom and with face to face capability.  Time to accomplish tasks without intercom and with face to face capability.  Time to accomplish tasks without intercom and without face to face capability.  Time to accomplish tasks without intercom and without and crew tasks at one hour intervals over a period of 48 hours with Time to accomplish tasks without face to face capability.  Determine casualty Time to accomplish tasks without intercom and with face to face capability.  Determine Time to accomplish tasks without intercom and with face to face capability.  Time to accomplish tasks without intercom and without face to face capability.  Time to accomplish tasks without intercom and without face to face capability.  Time to accomplish tasks without intercom and without face to face capability.	Experime
Intercom working and not.  NBC environment and Normal environment.  How is crew coordination effected.  Time to accomplish TBD tasks with face to face capability.  Time to accomplish tasks without intercom and with face to face capability.  Time to accomplish tasks without intercom and with face to face capability.  Time to accomplish tasks without intercom and without face to face capability.  What conditions allow partial or no visibility.  Intercom working or not.  NBC environment and normal environment.  How is crew coordination effected.  Time to accomplish tasks without face to face visibility capability.  Time to accomplish tasks without intercom and with face to face capability.  Time to accomplish tasks without intercom and with face to face capability.	All Crew members have face-to-face capability   SIL, Virtual
NBC environment and Normal environment.  How is crew coordination effected.  Time to accomplish TBD tasks with face to face capability.  Time to accomplish tasks without face to face capability.  Time to accomplish tasks without intercom and with face to face capability.  Time to accomplish tasks without intercom and without face to face capability.  What conditions allow partial or no visibility.  Intercom working or not.  NBC environment and normal environment.  How is crew coordination effected.  Time to accomplish TBD tasks with face to face visibility capability.  Time to accomplish tasks without face to face capability.  Time to accomplish tasks without intercom and with face to face capability.  Time to accomplish tasks without intercom and with face to face capability.	
How is crew coordination effected.  Time to accomplish TBD tasks with face to face capability.  Time to accomplish tasks without face to face capability.  Time to accomplish tasks without intercom and with face to face capability.  Time to accomplish tasks without intercom and with face to face capability.  What conditions allow partial or no visibility.  Intercom working or not.  NBC environment and normal environment.  How is crew coordination effected.  Time to accomplish TBD tasks with face to face visibility capability.  Time to accomplish tasks without face to face capability.  Time to accomplish tasks without intercom and with face to face capability.  Time to accomplish tasks without intercom and with face to face capability.	
Time to accomplish TBD tasks with face to face visibility capability.  Time to accomplish tasks without face to face capability.  Time to accomplish tasks without intercom and with face to face capability.  Time to accomplish tasks without intercom and with out face to face capability.  What conditions allow partial or no visibility.  Intercom working or not.  NBC environment and normal environment.  How is crew coordination effected.  Time to accomplish TBD tasks with face to face visibility capability.  Time to accomplish tasks without face to face capability.  Time to accomplish tasks without intercom and with face to face capability.	
Time to accomplish tasks without face to face capability.  Time to accomplish tasks without intercom and with face to face capability.  Time to accomplish tasks without intercom and without face to face capability.  What conditions allow partial or no visibility.  Intercom working or not.  NBC environment and normal environment.  How is crew coordination effected.  Time to accomplish TBD tasks with face to face visibility.  Time to accomplish tasks without face to face capability.  Time to accomplish tasks without intercom and with face to face capability.  Time to accomplish tasks without intercom and with face to face capability.	
Time to accomplish tasks without intercom and with face to face capability.  Time to accomplish tasks without intercom and without face to face capability.  What conditions allow partial or no visibility.  Intercom working or not.  NBC environment and normal environment.  How is crew coordination effected.  Time to accomplish TBD tasks with face to face visibility capability.  Time to accomplish tasks without face to face with face to accomplish tasks without intercom and with face to face capability.  Time to accomplish tasks without intercom and with face to face capability.	
Time to accomplish tasks without intercom and without face to face capability.  What conditions allow partial or no visibility.  Intercom working or not.  NBC environment and normal environment.  How is crew coordination effected.  Time to accomplish TBD tasks with face to face visibility capability.  Time to accomplish tasks without face to face capability.  Time to accomplish tasks without intercom and with face to face capability.  Time to accomplish tasks without intercom and with face to face capability.	
What conditions allow partial or no visibility.  Intercom working or not.  NBC environment and normal environment.  How is crew coordination effected.  Time to accomplish TBD tasks with face to face visibility capability.  Time to accomplish tasks without face to face capability.  Time to accomplish tasks without intercom and with face to face capability.  Time to accomplish tasks without intercom and with face to face capability.	
	SIL, Virtual
· · · · · · · · · · · · · · · · · · ·	

Subject of Experimentation/Testing: AFAS Crew Positions

Specifications	Environments for Testing/ Experimentation	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Elements (X = Insupportable by DIS PDUs)
Between Crew and Weapon Stations	SIL, Virtual	Establish base line times for individual and crew tasks at one hour at one hours with visibility between crew members and weapon stations.  What conditions require visibility, how often do the conditions require visibility, how often do the conditions arise, etc.	Determine time to diagnose equipment malfunctions with direct visibility into weapons compartment and without direct view into weapons compartment.  Determine time to detect dangerous situations and malfunctions with direct visibility into weapons compartment and without direct view into weapons compartment.	X(I).
Intravisibility Between docked/docking vehicles	Virtual	Direct sight lines from crew stations to the other vehicle.	Direct view or remote.  Are mirrors and lenses sufficient?  Is TV sufficient or better.  Time to dock with intravisibility.  Time to dock without intravisibility.	X(1).
Into Vehicle Compartments.	SIL, Simulator, Virtual	Direct sight lines from all crew stations to the vehicle compartments	Direct view or remote.  Are mirrors and lenses sufficient?  Is TV sufficient or better.	X(1).

Subject of Experimentation/Testing: AFAS Crew Positions

Specifications	Environments for Testing/	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate	Existing, Modified, or New DIS PDUs Required to Collect Data Elements
Intravisibility Between mained bountered	Virtual	Direct sight	Direct view or remote.	X(1).
Detween paired nowitzers.		crew stations	Are mirrors and lenses sufficient?	
		to the other vehicle.	Is TV sufficient or better.	
			Ease of communication between howitzers.	
			Ease of maintaining situational awareness/orientation between howitzers.	
			Time to lay mission with intravisibility.	
			Time to lay mission without intravisibilty.	
Ergress Options Two or more egress options.	SIL, Simulator	Did crew get out of the	Experiment with different combinations of exits and X(1), different emergency egress situations.	X(t).
		TBD seconds.	Time crew determines to egress.	
			Time egress started.	
			Time egress finished.	
			Time for each person to egress.	
			Elapsed time for all crew members to egress.	
			All crew members egress the vehicle without injury or damage to the vehicle.	

Specifications	Environments for Testing/	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Elements (X = Insurroctable by DIS PDI in
Ergress Options Side Dwors	SIL, Simulator	Can crew members in the crew compartment get out of the vehicle within TBD seconds. Can all crew members egress the vehicle without injury or unnecessary damage to the vehicle.	Sufficient under all/most combat situations.  Time crew determines to egress.  Time egress started.  Time egress finished.  Time for each person to egress.  Elapsed time for all crew members to egress.  All crew members egress the vehicle without injury or damage to the vehicle.	X(I).
Ergress Options Top Hatch	SIL, Simulator	Can crew members in the crew compartment get out of the vehicle within TBD seconds. Can all crew members egress the vehicle without injury or unnecessary damage to the vehicle.	Immersion in water?  How many hatches?  Time crew determines to egress.  Time egress started.  Time for each person to egress.  Elapsed time for all crew members to egress.  All crew members egress the vehicle without injury or damage to the vehicle.	X(1).

Subject of Experimentation/Testing: AFAS Crew Positions

Cassifications	Carrieran active for	Massimon	Characteristics and Thirtie Pick Blancaster Co.	BALLET WALLE LAND ME BINE
	Testing/	Performance	Collection if DIS Virtual Simulation is Appropriate	Required to Collect Data Elements
	Experimentation			(X = Insupportable by DIS PDUs)
Ergress Options	SIL. Simulator	Can crew	Added safety during nost incident period when	χω
		mombore in		
		the crew	אבווירוב וס ווסו בוברו כו כיוובן ביווס ווסו פתוומחוב.	
		_		
		_	Time crew determines to egress.	
		Ξ	Time egress started.	
			Time egress finished.	
		Can all crew		
		members	Time for each person to egress.	
		egress the	•	
		vehicle	Plansed time for all crew members to egrees	
		without	trapec differential tien incliners to chiess.	
		injury or	All crew members egress the vehicle without injury	
		unnecessary	or damage to the vehicle.	
		damage to the		
		vehicle		
Ergress Options	SIL, Simulator	Can crew	Use as emergency exit or normal access during	X(1).
Ammunition/Gun Compartment		members in	manual rearm operations.	
		the primary		
		_	Time cross determines to server	
		_	THE CLEW DESCRIPTION OF BEESS.	
		_	į	
			Time egress started.	
		_	Time egress finished.	
		TBD seconds.		
		_	Time for each person to egress.	
		Can all crew		
		members	Elapsed time for all crew members to egress.	
		egress the		
		vehicle		
		without		
		injury or	-	
		unneresary	-	
		damage to the		-
		vehicle		
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Subject of Experimentation/Testing: AFAS Crew Positions

Specifications	Environments for	Measures of	Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs
	Testing/ Experimentation	Performance	Collection if DIS Virtual Simulation is Appropriate Environment	Required to Collect Data Elements (X = Insupportable by DIS PDUs)
Ergress Options Front Windows	SIL, Simulator	Can the crew	Examine as a possible emergency exit.	X(1).
		<u>_</u>	Time crew determines to egress.	
		i po seconds.	Time egress started.	
		Can all crew	Time egress finished.	
			Time for each person to egress.	
		without	Blapsed time for all crew members to egress.	
		_	All crew members egress the vehicle without injury	
	-	damage to the vehicle.	or damage to the vehicle.	
Crew Access	SIL, Simulator	T	Examine possible locations and methods of use.	X(1).
Access to stored munitions.		5		
			Examine possible secondary uses.	
			Time crew determined necessity to access	
		seconds? Can	munitions.	
		member access	member access Time crew began to access munitions.	
			Time crew accessed munitions.	
		other crew	lime crew began to move munitions.	
		perform their		
		primary tasks.		

Subject of Experimentation/Testing: AFAS Crew Positions

	Testing/	Performance	Collection if DIS Virtual Simulation is Appropriate	Required to Collect Data Elements
	Experimentation		Environment	(X = Insupportable by DIS PDUs)
	SIL, Virtual	_	Examine possible locations and methods of use.	X(1).
Access to the Primary Weapons Station		gain access to		
	-	the stored	Examine possible secondary uses.	
			Time crew determined necessity to access weapon	
		Can		
		each crew	Time crew began to access weapon.	
			Time crew accessed weapon.	
		and fire the	Time ready to fire.	
		the other crew	Crew safety during access to primary weapons	
		heir		
		primary tasks.		
Τ	SIL, Virtual	Can each crew	Examine possible locations and methods of use.	X(1).
Access to the Self Defense Weapons Station		-		
		access, aim	Time crew determined necessity to access weapon.	
			Time crew began to access weapon.	
		ē	0	
			Time crew accessed weapon.	
		_		
			Time ready to fire.	
		primary tasks.		
+	SIL, Virtual		Examine possible locations and methods of use.	X(1).
Access to Secondary Armament Ammunition		determined	•	
		necessity to	Examine possible secondary uses.	
		arress weapon.	Time crew determined necessity to access weapon.	
		Can each crew		
			Time crew began to access weapon.	
		and fire the	Time crew actually accessed weapon.	
			Time ready to fire.	
		the other crew		
		perform their		
		primary tasks.		

X(1). Note: DIS Simulation could provide an appropriate environment for testing and evaluation, however data on the DIS network would not generally support the measurements needed.

### Subject of Experimentation/Testing: AFAS Crew Positions

# 2. Technical and Operational Benefits of Experimentation with Crew Positions in DIS Virtual Environment.

#### 2.1 Stated specifications.

The crew must be able to efficiently perform specified duties from his crew position.

The crew must be able to see each other while in their crew positions, in the crew cab.

intravisibility between the AFAS and FARV during refueling operations.

Intravisibility between crew members at their crew positions and vehicle compartments.

Each crew member must have access to at least two egress options.

Crew members must have easy access to their alternate stations, i.e. secondary weapon, primary weapon loading area and storage areas.

- Other Aspects of Performance Measurable in a DIS Virtual Environment. Is face-to-face visibility required? What degree of intervisibility is required when crew members are out of their seats performing secondary tasks like loading Copperhead rounds or clearing jammed equipment. How is crew efficiency effected. How is overall system safety effected. 77
- evaluating relative crew efficiency with and without visibility under operational conditions. Data needed to indirectly evaluate crew efficiency will be generated as the crew responds to the scenario. One critical aspect to evaluate is the degree to which intervisibility enhances safety, crew coordination, and operations with a contaminated crew cab. 2.3 Sample Experiment. There are several efficiency and safety related aspects that can be evaluated while operating in a DIS environment. DIS can only provide an environment (or
- Set up a standard combat scenario. From previous tests, establish baseline times to accomplish standard tasks such as rearming, firing, repositioning, etc. Run the scenario times while varying the degrees of visibility between the crew members inside the crew cab, the ammunition storage racks and loading compartment. Measure any the times to accomplish the standard tasks and compare them to the base line.

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- 2. Run the same scenarios, only with a contaminated crew cab so that all crew members are in MOPP-4, and have one crew member simulate suffering from NBC poisoning, and say how long it takes the other crew members to discover the poisoned crew member.
- 3. Run the same scenarios given above. This time the crew must perform their duties without the use of the intercom system, where alternate forms of communication, including visual signals, are likely to be used. Evaluate the impact on mission effectiveness of varying combinations of lack of visibility and intercom communication capability.

#### 3. Required Resources.

To support experimentation and testing in the areas identified above the following resources are required:

- One AFAS crew to man an AFAS simulator's crew cab.
- One fully equipped AFAS simulator with BCC, radios, modems, crew stations, crew displays, supporting software, with access to M712 Copperhead rounds in the ammunition sturage
- One observer/SAFOR to acquire and submit calls for fire to engage opposition force targets on the virtual battlefield.
- One fire direction computer operator
- One AFATDS POC computer to process the observer's call for fire during centralized AFAS operations, automatically relay calls for fire during decentralized operations, and update AFAS information base on fire support coordination measures and battlefield geometry, meteorological data, and preplanned targets.

### Subject of Experimentation/Testing: AFAS Crew Positions

- One FARV SAFOR to support resupplying operations.
- One AFAS SAFOR to support senior to subordinate AFAS operations.
- Threat SAFOR operations order.
- Threat SAFOR to execute the order.
- · Friendly force operations order with fire support coordination measures and battlefield geometry.
- Friendly SAFOR to execute the order.
   Emulators Required. The following models or emulations will be needed to support the AFAS simulator.

Subject of Experimentation/Teeting: FARV Crew Positions

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Specifications	Environments for Testing	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate	Existing, Modified, or New DIS PDUs Required to Collect Data Elements
	Experimentation		Environment	(X = Insupportable by DIS PDUs)
Crew Positions		Can crew members	Under normal operating conditions:	
		perform their	Time required task initiated.	Event report PDU
		(TBD) within	Time required task completed.	Event report PDU
		time limits	Specified time to complete task.	×
		positions.	Under degraded operating conditions:	
			Time required task initiated.	Event report PDU
			Time required task completed.	Event report PDU
			Specified time to complete task.	×
Intervisibility  Between Individual Crew Members		isibility ed for peration vehicle mance s and ns. having -face isibility en crew ers cc on n n n n n n n n n n n n n n n n n	Time tasks (TBD) requiring crew coordination begin. Event report PDU Time tasks requiring crew coordination end.  Event report PDU Increase or decrease in efficiency due to crew intervisibility	Bvent report PDU Event report PDU
		ment.		

Subject of Experimentation/Testing: FARV Crew Positions

	Testing/ Experimentation	Performance	Collection if DIS Virtual Simulation is Appropriate Environment	Required to Collect Data Elements (X = Insupportable by DIS PDUs)
All Crew members have face to face capability	SIL, Virtual	Establish base line times for individual	What conditions require full face to face capability. Intercom working and not.	Entity state PDU
		and crew tasks at one hour	NBC environment and normal environment.	
		a period of 48	How is crew coordination effected.	Xm
		face to face capabilities.	Time to accomplish TBD tasks with face to face visibility capability.	X <sub>(I)</sub> .
		Can each crew member see	Time to accomplish TBD tasks without face to face capability.	Xu).
		member's face from his crew	Time to accomplish TBD tasks without intercom and with face to face capability.	X(ι).
		position.	Time to accomplish tasks without intercom and without face to face capability.	X <sub>(I)</sub> ,
Partial Body Visibility	SIL, Virtual	Establish base	What conditions allow partial or no visibility.	
		individual	Intercom working or not.	Entity state PDU
		and crew tasks at one hour	NBC environment and normal environment.	
		a period of 48	How is crew coordination effected.	X(t).
		nours with partial visibility	Time to accomplish TBD tasks with face to face visibility capability.	X <sub>(I)</sub> ,
		between crew members.	Time to accomplish tasks without face to face capability.	X <sub>(B)</sub>
		Determine casualty monitoring	Time to accomplish tasks without intercom and with face to face capability.	X <sub>(I)</sub> .
		Capabilities.	Time to accomplish tasks without intercom and without face to face capability.	X <sub>(1)</sub> .

Subject of Experimentation/Testing: FARV Crew Positions

Specifications	Environments for Testing/ Experimentation	Measures of Performance	Characteristics and Their Data Blements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Blements (X = Insupportable by DIS PDUs)
v and Storage, Handling Equipme	III, Virtual	<u>}</u>	grose equipment ct visibility, how often do the grose equipment ct visibility into weapons out direct view into weapons ct dangerous situations and ct visibility into weapons out direct view into weapons	X <sub>(D)</sub> .
Intravisibility Between docked/docking vehicles	Virtual	Direct sight lines from crew stations to the other vehicle.	Direct view or remote.  Are mirrors and lenses sufficient? Is TV sufficient or better.  Time to dock with intravisibility.	X(1). X(1). Event report PDU
Into Vehicle Compartments.  Ergress Options Two or more egress options.	SIL, Virtual, Simulator SIL, Simulator	Can each crew member must have at least two different exits/exit routes to get out of the vehicle in case of emergency from each crew position and work area.	Mirrors and lenses sufficient? TV sufficient or better.  Experiment with different combinations of exits and different emergency egress situations.  Time crew determines to egress.  Time egress started.  Time for each person to egress.  Time for each person to egress.  All crew members egress the vehicle without injury or damage to the vehicle.	X(1).  Event response PDU  Event report PDU  Event report PDU  X(1).  X(1).

Subject of Experimentation/Testing: FARV Crew Positions

Egress Options SIL		Performance	Collection if DIS Virtual Simulation is Appropriate	Required to Collect Data Blamenta
	Experimentation		Environment	(X = Insupportable by DIS PDUs)
		Can crew members in	Sufficient under all/most combat situations.	X <sub>(I).</sub>
			Time crew determines to egress.	Event report PDU
			Time egress started.	Event report PDU
			Time egress finished.	Event report PDU
		ž.	Time for each person to egress.	X <sub>(I)</sub> ,
		ري و د	Elapsed time for all crew members to egress.	X(1).
			All crew members egress the vehicle without injury X(1).	X <sub>(1).</sub>
		injury or	or damage to the vehicle.	
		damage to the vehicle.		
Top Hatch SIL	SIL, Simulator	Can crew	Added safety during immersion in water? How	
		Ë	many hatches?	
			Time crew determines to egress.	Event report PDU
	•	get out of the	Time sorses started	I I I I I I I I I I I I I I I I I I I
		TBD seconds.	בווונ כאונסס סופונכת.	
			Time egress finished.	Event report PDU
		members	Time for each person to egress.	X <sub>(i)</sub> .
		egress the		
		without		
		injury or		
		damage to the		
	-	vehicle.		

Subject of Experimentation/Testing: FARV Crew Positions

Specifications	Environments for Testing/	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate	Existing, Modified, or New DIS PDUs Required to Collect Data Elements
	Experimentation		Environment	(X = Insupportable by DIS PDUs)
Egress Options  Bottom Hatch	SIL, Simulator	Can crew members in	Added safety during post incident period when vehicle is not erect or other exits not suitable	
		the crew		
		compartment	Time crew determines to egress.	Event report PDU
		get out or the vehicle within	get ou or une vehicle within Time egress started.	Event report PDU
-		TBD seconds.	Timo agrees finished	Ploof sevent POI
		Can all crew		
		members	Time for each person to egress.	X(II).
		egress tne vehicle	Elapsed time for all crew members to egress.	X <sub>(II)</sub> .
		without		
		injury or	All crew members egress the venicle without	A(I), / Enfity state I/UU
		unnecessary	injury or damage to the vehicle.	
		damage to the vehicle.		
	C11 C1-11-6-2			
l Egress Options	SIL, Simulator	Can crew	Use as emergency exit or normal access during	
Ammunition/Storage Compartment		members in	manual rearm operations.	
		amminition	Time crew determines to excess	Event renort PDI
		storage		
		tment	Time egress started.	Event report PDU
		get out of the		
		vehicle within	vehicle within Time egress finished.	Event report PDU
		i DC seconds.	Time for each person to egress.	Ë
		Can all crew	•	
		members	Elapsed time for all crew members to egress.	Entity state PDU
		egress the		
		without		
		injury or		
		unnecessary		
		damage to the vehicle.		

Subject of Experimentation/Testing: FARV Crew Positions

Specifications	Environments for Testing/	Measures of	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Ammoriate	Existing, Modified, or New DIS PDUs Required to Callect Data Florents
	Experimentation		Environment	(X = Insupportable by DIS PDUs)
Ergress Options Front Windows	SIL, Simulator	Can the crew get out of the	Examine front windows as a possible emergency exit.	
		vehicle within	vehicle within Time crew determines to egress.	Event report PDU
			Time egress started.	Event report PDU
			Time egress finished.	Event report PDU
			Time for each person to egress.	X <sub>(1)</sub> ,
			Elapsed time for ail crew members to egress.	X <sub>(1)</sub> .
			All crew members egress the vehicle without injury or damage to the vehicle.	X <sub>(1).</sub> / Entity state PDU
Crew Access	SIL, Simulator	Can each crew	Examine possible locations and methods of use.	
		the stored	Time crew determined necessity to access munitions. Event report PDU	Event report PDU
		while the	Time crew began to access munitions.	Event report PDU
		members	Time crew accessed munitions.	Event report PDU
		periorm meir primary tasks.	Time crew began to move munitions.	Entity state PDU
Crew Access	SIL, Simulator	Can each crew	The description of the solution of the solution of the contraction of	hile the other crew members perform
Access to the Self Defense Weapons Station		unen primary tasks. Tim	sas. Time crew determined necessity to access weapon.	Event report PDU
			Time crew began to access weapon.	Event report PDU
			Time crew accessed weapon.	Event report PDU
			Time ready to fire.	Entity state PDU

Subject of Experimentation/Testing: FARV Crew Positions

Environments for Measures of Characteristics and Their Data Elements for Experiments for Measures of Collection if DIS Virtual Simulation is Appropriate Required to Collect Data Elements  Experimentation  Output  Discrepance of Characteristics and Their Data Elements for Experiments  Experiments for Measures of Collection if DIS Virtual Simulation is Appropriate Required to Collect Data Elements  Experiments for Measures of Collection if DIS Virtual Simulation is Appropriate (X = Insupportable by DIS PDUs)	Time crew Examine possible locations and methods of use.	determined	necessity to Examine possible secundary uses.	access weapon.	Time crew determinant sity to access weapon. Event report PDU	member Time crew began %	access, aim	and fire the Time crew actually 7 d weapon.	self defense	weapon while   Time ready to fire.   Entity state PDU	the other crew	mempers	perform their	
Specifications	Crew Access	Access to Secondary Armament Ammunition												

X(1). Note: DIS Simulation could provide an appropriate environment for testing and evaluation, however data on the DIS network would not generally support the measurements needed.

#### Subject of Experimentation/Testing: FARV Crew Positions

- 2. Technical and Operational Benefits of Experimentation with Crew Intervisibility and Intravisibility in DIS Virtual Environment.
- 2.1 Stated specifications
- The crew must be able to efficiently perform specified duties from his crew position.
- The crew must be able to see each other while in their crew pusitions, in the crew cab.
- Intravisibility between the AFAS and FARV during refueling operations.
- Intravisibility between crew members at their crew positions and vehicle compartments.
- Each crew member must have access to at least two egress options.
- Crew members must have easy access to their alternate stations, i.e. secondary weapon, primary weapon loading area and storage areas
- 2.2 Other Aspects of Performance Measurable in a DIS Virtual Environment. Is face-to-face visibility required? What degree of intervisibility is required when crew members are out of their seats performing secondary tasks like loading Copperhead rounds or clearing jammed equipment. How is crew efficiency effected. How is overall system safety effected.
- 3 DIS can only provide an environment 2.3 Sample Experiment. There are several efficiency and safety related aspects that can be evaluated while operating in a DIS environment. DIS can only provide an environment evaluating relative crew efficiency with and without visibility under operational conditions. Data needed to indirectly evaluate crew efficiency will be generated as the crew responds to scenario. One critical aspect to evaluate is the degree to which intervisibility enhances safety, crew coordination, and operations with a contaminated crew cab.
- 1. Set up a standard combat scenario. From previous tests, establish baseline times to accomplish standard tasks such as rearming, firing, repositioning, etc. Run the scenario several times while varying the degrees of visibility between the crew members inside the crew cab, the ammunition storage racks and loading compartment. Measure any the times needed to accomplish the standard tasks and compare them to the base line.

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- Run the same scenarios, only with a contaminated crew cab so that all crew members are in MOPP-4, and have one crew member simulate suffering from NBC poisoning, and sex how long it takes the other crew members to discover the poisoned crew member.
- Run the same scenarios given above. This time the crew must perform their duties without the use of the intercom system, where alternate forms of communication, including visual signals, are likely to be used. Evaluate the impact on mission effectiveness of varying combinations of lack of visibility and intercom communication capability
- Required Resources. To support experimentation and testing in the areas identified above the following resources are required: ų.
- One AFAS crew to man an AFAS simulator's crew cab.
- One fully equipped AFAS simulator with BCC, radios, modems, crew stations, crew displays, supporting software, with access to M712 Copperhead rounds in the ammunition storage
- One observer/ SAFOR to acquire and submit calls for fire to engage opposition force targets on the virtual battlefield.
- One fire direction computer operator
- One AFATDS POC computer to process the observer's call for fire during centralized AFAS operations, automatically relay calls for fire during decentralized operations, and update AFAS information base on fire support coordination measures and battlefield geometry, meteorological data, and preplanned targets.
- One FARV SAFOR to support resupplying operations.
- One AFAS SAFOR to support senior to subordinate AFAS operations.

### Subject of Experimentation/Testing; FARV Crew Positions

- Threat SAFOR operations order.
- Threat SAFOR to execute the order.
- Friendly force operations order with fire support coordination measures and battlefield geometry.
- 4. Emulators Required. The following models or emulations will be needed to support the AFAS simulator. Friendly SAFOR to execute the order.

Subject of Experimentation/Testing. AFAS Environment.

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Specifications	Environments for	Measures of	Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs
•	Testing/ Experimentation	Performance	Collection if DIS Virtual Simulation is Appropriate Environment	Required to Collect Data Elements (X = Insupportable by DIS PDUs)
Crew Environment				
Normal Operations	SIL, Virtual	Establish base line times for individual and crew tasks at one hour intervals over a period of 48 hours with full system capabilities.	plish	X(t).
NBC Operations	SiL, Virtual		Measure times Determine crew loading, crew coordination to complete requirements, under varying workloads.  baseline tasks at one hour Time task(s) (TBD) began. intervals over Time task(s) ended.  Determine the accomplishing task(s) compared to baseline time required to accomplish task(s) determined earlier. from Normal Determine difference in crew performance when baseline tasks.	X(1).
Arctic Operations	SIL, Virtual	Measure times to complete baseline tasks at one hour intervals over 48 hour period. Determine the difference dominate of the paseline tasks.	Measure times Determine crew loading, crew coordination to complete requirements, under varying workloads.  baseline tasks at one hour lime task(s) (TBD) began.  Time task(s) ended.  Determine the difference between time required for accomplishing task(s) compared to baseline time from Normal required to accomplish task(s) determined earlier.  Operations baseline tasks.  Determine difference in crew performance when crew compartment cooling/heating is inoperative.	X(g).

Subject of Experimentation/Testing. AFAS Environment

Specifications	Environments for Testing/ Experimentation	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Elements (X = Insupportable by DIS PDUs)
Tropical Operations	SIL, Virtual	Measure times to complete baseline tasks at one hour intervals over 48 hour period. Determine the difference from Normal Operations baseline tasks.	Measure times Determine crew loading, crew coordination to complete requirements, under varying workloads.  Is one hour Time task(s) (TBD) began.  Time task(s) ended.  Determine the accomplishing task(s) compared to baseline time required to accomplish task(s) determined earlier.  Operations  Determine difference in crew performance when crew compartment cooling is inoperative.	(i)
Desert Operations	SIL, Virtual	Measure times to complete baseline tasks at one hour intervals over 48 hour period. Determine the difference from Normal Operations baseline tasks.	Determine crew loading, crew coordination requirements, under varying workloads.  Time task(s) (TBD) began.  Time task(s) ended.  Determine difference between time required for accomplishing task(s) compared to baseline time required to accomplish task(s) determined earlier.  Determine difference in crew performance when crew compartment cooling/heating is inoperative.	X(1).
Long Term Operations	SIL, Virtual	Measure times to complete baseline tasks at one hour intervals over 48 hour period. Determine the difference difference difference difference baseline tasks.	Determine crew loading, crew coordination requirements, under varying workloads.  Time task(s) (TBD) began.  Time task(s) ended.  Determine difference between time required for accomplishing task(s) compared to baseline time required to accomplish task(s) determined earlier.  Determine difference in crew performance when crew compartment cooling/heating is inoperative.	X(1).

Subject of Experimentation/Testing. AFAS Environment

Specifications	Environments for Testing/Experimentation		Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Elements (X = Insupportable by DIS PDUs)
Abnormal Operations	SIL, Virtual	Measure times to complete baseline tasks at one hour intervals over 48 hour period. Determine the difference from Normal Operations baseline tasks.	Determine crew loading, crew coordination requirements, under varying workloads with degraded environmental and life support systems.  Time task(s) (TBD) began.  Time task(s) ended.  Determine difference between time required for accomplishing task(s) compared to baseline time required to accomplish task(s) determined earlier.	X(1).
Manual Ammunition Handling Capability	SIL, Virtual	Can the crew manually select and load a round.	Different equipment configurations, techniques, environmental conditions, etc. Time reload started. Time reload ended.	X(1).
Crew Access To Ammunition Storage	Sil., Virtual	Can the crew have easy access to ammunition storage and loading area.	Different equipment configurations, techniques, environmental conditions, etc.  Time Copperhead Mission Arrived.  Time Crew member left crew position.  Time Crew member begins preparing the round to fire.	X(1).
Internal room to Handle All Ammunition and Propellant	SIL, Virtual	Can the crew manually select and load a round without performing awkward movements or face an high risk of injury.	Different equipment configurations, techniques, environmental conditions, etc.  Time manual reload starts.  Time manual reload ends.  Number of combined bending and lifting motions.  Number of combined lifting and twisting motions involved.	X(1).

X(1). Note: DIS Simulation could provide an appropriate environment for testing and evaluation, however data on the DIS network would not generally support the measurements needed.

Subject of Experimentation/Testing. AFAS Environment

- 2. Technical and Operational Benefits of Experimentation with Crew Environments in DIS Virtual Environment.

  2.1 Stated Specifications. Crew must be able to perform continuous operations for a minimum of 48 hours without leaving the crew cab. An implied specification is that the crew environment is not included in the 48 hour specification, so that to completely test the specification, at least one series of tests will require that the crew wear NBC gear. The DIS can only provide a long period of time under operational conditions. Data needed to indirectly evaluate crew efficiency will be generated as the crew responds to the scenario.

  2.2 Other Aspects of Performance Measurable in a DIS Virtual Environment. N/A.

  2.3 Sample Experiment. Set up a standard 48 hour scenario. From previous tests, establish some baseline times to accomplish standard tasks and compare them to the base line.

  3. Required Resources.

To support experimentation and testing in the areas identified above the following resources are required:

- One AFAS crew to man an AFAS simulator's crew cab
- One fully equipped AFAS simulator with BCC, radios, modems, crew stations, crew displays, supporting software, with access to M712 Copperhead rounds in the ammunition storage area
- One observer/SAFOR to acquire and submit calls for fire to engage opposition force targets on the virtual battlefield
- One fire direction computer operator
- One AFATDS POC computer to process the observer's call for fire during centralized AFAS operations, automatically relay calls for fire during decentralized operations, and update AFAS infin d geometry, meteorological data, and preplanned targets
- One AFAS SAFOR to support senior to subordinate AFAS operations.
- Threat SAFOR operations order
- Threat SAFOR to execute the order
- Friendly force operations order with fire support coordination measures and battlefield geometry.
- Friendly SAFOR to execute the order
- 4. Emulators Required. The following models or emulations will be needed to support the AFAS simulator

Subject of Experimentation/Testing. FARV Environment.

1. Data Collection Requirements		
	.0	-

Specifications	Environments for Testing/ Experimentation	Messures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Hements (X = Insupportable by DIS PDUs)
Crew Environment Normal Operations	SIL, Virtual	Establish base line times for individual and crew tasks at one hour intervals over a period of 48 hours with full system capabilities.	Determine crew task loading, crew coordination requirements, and physical effort expended under varying workloads.  Time task(s) (TBD) began.  Time task(s) ended.  Determine baseline time required to accomplish task(s).	X(1). Event report PDU Event report PDU X(1).
Crew Environment NBC Operations	SIL, Virtual	Measure times to complete baseline tasks at one hour intervals over 48 hour period.  Determine the difference from Normal Operations baseline tasks.	Measure times Determine crew loading, crew coordination to complete requirements, under varying workloads.  baseline tasks at one hour rime task(s) (TBD) began.  Time task(s) ended.  Determine the accomplishing task(s) compared to baseline time required to accomplish task(s) determined earlier.  from Normal Determine difference in crew performance when baseline tasks.  Crew compartment cooling/heating is inoperative.	X(1). Event report PDU Event report PDU X(1). X(1).
Crew Environment Arctic Operations	SIL, Virtual	Measure times to complete baseline tasks at one hour intervals over 48 hour period.  Determine the difference from Normal Operations baseline tasks.	Determine crew loading, crew coordination requirements, under varying workloads.  Time task(s) (TBD) began.  Time task(s) ended.  Determine difference between time required for accomplishing task(s) compared to baseline time required to accomplish task(s) determined earlier.  Determine difference in crew performance when crew compartment cooling/heating is inoperative.	X(1). Event report PDU Event report PDU X(1). X(1).

Subject of Experimentation/Testing, FARV Environment.

Specifications	Environments for Testing	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate	Existing, Modified, or New DIS PDUs Required to Cellect Data Blements
	Experimentation			mont on to anomode many = Y
Crew Environment Tropical Operations	oil, virtuai		Determine crew loading, crew coordination requirements, under varying workloads.	X(1).
		at one hour	Time task(s) (TBD) began.	Event report PDU
		intervals over	Time task(s) ended.	Event report I'DU
		period.	Determine difference between time required for	
		Determine the difference	accomplishing task(s) compared to baseline time required to accomplish task(s) determined earlier.	Xu
		from Normal Operations		
		baseline tasks.		
Crew Environment	SIL, Virtual	\$		
Desert Operations		to complete baseline tasks	requirements, under varying workloads.	X(1).
		at one hour	Time task(s) (TBD) began.	Event report PDU
		Intervals over	Time task(s) ended.	Event report PDU
		period.	Determine difference between time required for	
		Determine the	accomplishing task(s) compared to baseline time	
		from Normal	required to accomplish task(s) determined earlier.	X(1).
		Operations	Determine difference in crew performance when grow commartment coding/heating is invareative	
				X(1).
Crew Environment Long Term Operations	SIL, Virtual	Quantify fatigue factors.	Determine crew loading, crew coordination requirements, under varying workloads.	X(1).
		ş	Time task(s) (TBD) began.	Event report PDU
		to complete baseline tasks	Time task(s) ended.	Event report PDU
		at one nour intervals over	Determine difference between time required for	
		96 hour period.	accomplishing task(s) compared to baseline time required to accomplish task(s) determined earlier.	X(1).
		the		
		from Normal	crew compartment cooling/ neating is inoperative.	X(1).
		baseline tasks.		

Subject of Experimentation/Testing. FARV Environment.

Crew Environment   St., Virtual   Care We Environment   St., Virtual   Care We Access To Ammunition Storage   St., Virtual   Care We Access To Ammunition and St., Virtual   Care We achieved a started.   Care We achieved a star	Specifications	Environments for	Measures of	Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs
SIL, Virtual Measure times to complete baseline tasks at one hour intervals over 48 hour peralical.  On Transfer Capability SIL, Virtual Can the crew transfer TBD minutes.  Immunition Storage SIL, Virtual Gainto the ammunition storage area without disrupting other mission operations storage area without TBD seconds.  andle all ammunition and SIL, Virtual Gaint to the storage area without risk of injury.		1 esting/ Experimentation	remormance	Collection if DIS Vittual Simulation is Appropriate  Environment	Kequired to Collect Usta Elements (X = Insupportable by DIS PDUs)
mmunition Transfer Capability  ss To Ammunition and SiL, Virtual  seconds  om to handle all ammunition and SiL, Virtual  seconds.  Sil, Virtual  can the crew get into the ammunition storage area without disrupting other mission operations seconds.  Sil, Virtual  can the crew get into the ammunition and storage area without disrupting other mission operations seconds.  Sil, Virtual  can the crew aget into the ammunition and Sil, Virtual  seconds.  com to handle all ammunition and Sil, Virtual  seconds.  can the crew and load special munitions without risk of injury.	Crew Environment Abnormal Operations	SIL, Virtual	səi	Determine crew loading, crew coordination requirements, under varying workloads.	X(1).
mmunition Transfer Capability  ss To Ammunition Storage  ss To Ammunition and to handle all ammunition special munitions without the special munitions without risk of injury.			baseline tasks		
mmunition Transfer Capability  ss To Ammunition Storage  ss To Ammunition and to handle all ammunition special munitions without risk of injury.			at one hour	Time task(s) (TBD) began.	Event report PDU
mmunition Transfer Capability  ss To Ammunition Storage  storage area without the ammunition storage area without the ammunition storage area without TBD  seconds.  Can the crew safely prepare and load special munitions without risk of injury.			intervals over 48 hour	Time task(s) ended.	Event report PDU
mmunition Transfer Capability SIL, Virtual Can the crew transfer TBD rounds of ammunition in TBD minutes.  SIL, Virtual Can the crew get into the ammunition storage area without disrupting other mission operations within TBD seconds.  Om to handle all ammunition and SIL, Virtual safely prepare and load special munitions without risk of injury.					
mmunition Transfer Capability  ss To Ammunition Storage  ss To Ammunition Storage  ss To Ammunition Storage  ss To Ammunition and SIL, Virtual  can the crew get into the ammunition storage area without disrupting other mission operations within TBD seconds.  Sill, Virtual  seconds  seconds  seconds  seconds  seconds  seconds  seconds  special  munitions  without risk of injury.			_	Determine difference between time required for	
mmunition Transfer Capability SIL, Virtual Can the crew transfer TBD rounds of ammunition in TBD minutes.  Str. Virtual Can the crew get into the ammunition storage area without disrupting other mission operations within TBD seconds.  Om to handle all ammunition and SIL, Virtual Can the crew safely prepare and load special munitions without risk of injury.			E	accompnianing task(s) compared to baseline time required to accomplish task(s) determined earlier.	X(I).
mmunition Transfer Capability  ss To Ammunition Storage  ss To Ammunition Storage  ss To Ammunition Storage  SiL, Virtual  SiL, Virtual  Sit into the ammunition storage area without disrupting other mission operations within TBD seconds.  Can the crew as a safely prepare and load special munitions without risk of injury.			from Normal	•	
mmunition Transfer Capability SIL, Virtual Can the crew transfer TBD rounds of ammunition in TBD minutes.  SS To Ammunition Storage SIL, Virtual Can the crew get into the ammunition storage area without disrupting other mission operations within TBD seconds.  Can the crew safely prepare and load special munitions without risk of injury.			۲	Determine difference in crew performance when	
mmunition Transfer Capability SIL, Virtual transfer TBD rounds of ammunition in TBD minutes.  SIL, Virtual Can the crew get into the ammunition storage area without disrupting other mission operations within TBD seconds.  Can the crew asfety prepare and load special munitions without risk of injury.				0	X(1).
transfer TBD rounds of ammunition in TBD minutes.  SIL, Virtual Can the crew get into the ammunition storage area without disrupting other mission operations within TBD seconds.  Can the crew asfety prepare and load special munitions without risk of injury.	Manual Ammunition Transfer Capability	SIL, Virtual	1	Different equipment configurations, techniques,	
ss To Ammunition Storage  SIL, Virtual  ammunition storage  SIL, Virtual  Gan the crew get into the ammunition storage area without disrupting other mission operations within TBD seconds.  Can the crew askely prepare and load special munitions without risk of injury.			transfer TBD	environmental conditions, etc.	X(1).
in TBD minutes.  SIL, Virtual get into the ammunition storage area without disrupting other mission operations within TBD seconds.  Can the crew disrupting other mission operations within TBD seconds.  Can the crew asfely prepare and load special munitions without risk of injury.				Time reload started.	Event report PDU
SIL, Virtual  Can the crew get into the ammunition storage area without disrupting other mission operations within TBD seconds.  Can the crew asfety prepare and load special munitions without risk of injury.				Time reload ended	To the second of
SIL, Virtual  Can the crew get into the ammunition storage area without disrupting other mission operations within TBD seconds.  Can the crew safely prepare and load special munitions without risk of injury.					באפוו ובאסו ובאסו
get into the ammunition storage area without disrupting other mission operations within TBD seconds.  Can the crew asfety prepare and load special munitions without risk of injury.	Crew Access To Ammunition Storage	SIL, Virtual	Т	Different equipment configurations, techniques,	
sorage area without disrupting other mission operations within TBD seconds.  Can the crew safely prepare and load special munitions without risk of injury.				environmental conditions, etc.	X(1).
without disrupting other mission operations within TBD seconds.  Can the crew safely prepare and load special munitions without risk of injury.			storage area	Time Copperhead Mission Arrived.	Event report PDU
disrupting disrupting other mission operations within TBD seconds.  Can the crew safely prepare and load special munitions without risk of injury.			without		
operations operations within TBD seconds.  Seconds.  Seconds.  Seconds.  Safely prepare and load special munitions without risk of injury.			disrupting	Time Crew member left crew position.	Event report PDU
within TBD seconds.  Seconds.  Can the crew safely prepare and load special munitions without risk of injury.			operations	Time Crew member begins preparing the round to	
om to handle all ammunition and SIL, Virtual Can the crew safely prepare and load special munitions without risk of injury.			within TBD	fire.	X(1).
om to handle all ammunition and SIL, Virtual Can the crew safely prepare and load and load special munitions without risk of injury.					
and load special munitions munitions without risk of injury.	Internal room to handle all ammunition and propellant	SIL, Virtual		Different equipment configurations, techniques, environmental conditions, etc.	X(I).
ons t risk ry.			and load special	Time manual reload starts.	Event report PDU
			munitions		
			without risk of injury.	Time manual reload ends.	Event report PDU
Amount of bending and twisting the crev perform while carrying or holding the ro				Times crew must reposition the round without support.	X(1).
perform while carrying or holding the ro				Amount of bending and twisting the crew must	
				perform while carrying or holding the round.	X(1).

X(1). Note: DIS Simulation could provide an appropriate environment for testing and evaluation, however data on the DIS network would not generally support the measurements needed.
2. Technical and Operational Benefits of Experimentation with Crew Environments in DIS Virtual Environment.

Subject of Experimentation/Testing. FARV Environment.

environment must be controlled so that continuous operations are possible anywhere in the world. The test will try to determine the effect of crew cab environment/life support systems failures on crew effectiveness over the 48 hour evaluation period. NBC protection, provided by a filtration system and crew compartment over-pressure system, is not included in the 48 hour specification, at the specification, at least one series of tests will require that the crew wear NBC gear. The DIS can only provide an environment for evaluating the crew efficiency over a long period of time under operational conditions. Data needed to indirectly evaluate crew efficiency will be generated as the crew responds to the scenario. Stated specifications. Crew must be able to perform continuous operations for a minimum of 48 hours without leaving the crew cab. An implied specification is that the crew

2.2 Other Aspects of Performance Measurable in a DIS Virtual Environment. N/A.

2.3 Sample Experiment. Set up a standard 48 hour scenario. From previous tests, establish some baseline times to accomplish standard tasks such as rearming, firing, repositioning, etc.

Run the scenario several times while varying the temperature and humidity inside the crew cab. Measure any the times needed to accomplish the standard tasks and compare them to the base

#### 3. Required Resources.

To support experimentation and testing in the areas identified above the following resources are required:

One FARV crew to man an FARV simulator's crew cab.

One fully equipped FARV simulator with radios, modems, crew stations, crew displays, supporting software, with access to M712 Copperhead rounds in the ammunition storage area

One AFAS crew to man an AFAS simulator's crew cab.

One fully equipped AFAS simulator with BCC, radios, modems, crew stations, crew displays, supporting software, with access to M712 Copperhead rounds in the ammunition storage area

One observer/ SAFOR to acquire and submit calls for fire to the AFAS to engage opposition force targets on the virtual battlefield

One fire direction computer operator

One AFATDS POC computer to process the resupply requests and manage FARV inventory during centralized AFAS operations, automatically relay resupply requests during decentralized operations, and update AFAS and FARV information base on ammunition requests and inventory on hand. One AFATDS POC computer to process the observer's call for fire during centralized AFAS operations, automatically relay calls for fire during decentralized operations, and update AFAS information base on fire support coordination measures and battlefield geometry, meteorological data, and preplanned targets.

One AFAS SAFOR to support senior to subordinate AFAS operations.

Threat SAFOR operations order.

Threat SAFOR to execute the order.

Friendly force operations order with fire support coordination measures and battlefield geometry.

Friendly SAFOR to execute the order.

Subject of Experimentation/Testing. AFAS and FARV System Safety

1. Data Collection Requirements

Existing, Modified, or New Dis PDUs riste Required to Collect Date Beneats (X = Unsupportable by DIS PDUs)		Entity State PDU	Event Report PDU	at	Entity State PDU	Entity State & Service Request PDUs	led Event Report PDU	ated Event Report PDU	Event Report PDU			of the data elements detailed under Location.		x,y,z	Fire PDU	Detonation PDU	Entity State PDU		
Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Number of operational AFASe and FARVs at end of experiment by type of hazard alert	ID of each operational vehicle	Types of hazard alerts activated by time and operational vehicle ID	Number of AFASs and FARVs sustaining combat damage and/or requiring unscheduled maintenance at end of experiment by type of hazard alert	ID of each disabled vehicle	Nature of combat damage or maintenance deficiency	Types of warnings activated by time and disabled vehicle ID	Identification of crew warning enunciators activated	Target number violating control measures	Location	Location of fire support coordination measure and battlefield geometry (maneuver control measure/unit location)	Location of target in call for fire	Location of AFAS howitzer	Location of projectile trajectory (as plotted on x,y,z	Number of Fratricides				
ires of mance	System survivability by type and	number of	received by the crew.		fire support	coordination measures and friendly	geometry in correlattion	fratricides	-							<u>-</u>			
Environments for Testing/	Live testing AFAS and FARV	simulators with	Subsystem															SIL and live testing	Live testing
Specifications	Hazard Alerts. The system shall provide both audible and visible warnings to alert the crew to internal and external hazardous situations.	e.g., fire, NBC contamination, LP spills, and	interrupt mission critical functions or create unsafe situations in tactical environments.															Software Safety. The system shall not allow correct or incorrect entries by the crew to cause a hazardous situation.	Emergency Override. The system shall allow for the crew to manually override automatic responses to equipment malfunction/out-of-

Subject of Experimentation/Testing. AFAS and FARV System Safety

Specifications	Environments for Testing/ Experimentation	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Edisting, Modified, or New DIS PDUs Required to Collect Data Elements (X = Unsupportable by DIS PDUs)
Finishing. Finished items shall have no raw, sharp, or rough edges. Edges and corners that	Live testing			
damage to the equipment shall be suitably				
Entrapment. Safeguards shall be installed to	Live testing			
prevent inadvertent contact with, or				
entrapment of, body parts or clothing in moving parts, hatches, or doors.				
Non-Skid Surfaces. Non-skid surfaces and	Live testing			
hand holds shall be provided in equipment	1			
mounting, traffic, and dismounting areas.				
Crew Station Restraints. Interior surfaces of	Live testing			
the crew station shall be padded or arranged to				
Insure the crew members are protected in crash				
or rough terrain operations. Restraint systems				
Engine Throttle Shut-Down. The system shall	Live testing			
have at least two independent controls capable	•			
of returning the throttle to idle position.				
Training Safety. The system shall include	Live testing			
safety features to prevent inadvertent live				
firings. The system shall indicate to the	System SIL			
operator when the system is in a training				-
mode.				

Subject of Experimentation/Testing. AFAS and FARV System Safety

Specifications	Environments for	Measures of	Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs
	Experimentation		Environment	(X = Unsupportable by DIS PDUs)
Crew Warnings. The system shall provide	Live testing	System	Number of operational AFASs and FARVs at end of	
warmings to the crew. These warmings shall not interrupt mission critical functions (shoot	AFAS and FARV	by type and	experiment by type of crew warning	
move, communicate, or survive) unless the	simulators with	number of	ID of each operational vehicle	Entity State PDU
warning is of an unsafe or hazardous	installed C3	hazard alerts	There are in the second of the second by second	Plant Brown a series
	nasystem	the crew.	operational vehicle ID	Event neport 1 DO
			Number of AFASs and FARVs sustaining combat	
		Detection and	damage and/or requiring unscheduled maintenance	
	_	warming of	at end of experiment by type of ci. w warning	
		fire support	ID of each disabled vehicle	Entity State PDU
		measures and	Nature of combat damage or maintenance	Entity State & Service Request PDUs
		friendly	deficiency	•
		geometry in	Types of warnings activated by time and disabled	Event Report PDU
		with		
		fratricides	Identification of crew warning enunclators activated	Event Report PDU
			Target number violating control measures	Event Report PDU
			Location	
			Location of fire support coordination measure and Recommend use of Event Report battlefield geometry (maneuver control measure/unit location)	Recommend use of Event Report PDU to report violations of control measures based on an examination
			Location of target in call for fire	of the data elements detailed under Location.
			Location of AFAS howitzer	
			Location of projectile trajectory (as plotted on x,y,z	
			Number of Fratricides	Fire PDU
				Detonation PDU
				Entity State PDU

Subject of Experimentation/Testing. AFAS and FARV System Safety

Specifications	Environments for	Measures of	Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs
	Experimentation	remormance	Collection if Dis Virtual Simulation is Appropriate Environment	(X = Unsupportable by DIS PDUs)
Lighting System. All controls and displays	AFAS and FARV		Time	
utilizing incandescent illumination and their	simulators with	controls and	Times and the second se	
nomenciature snatt be muminated with	installed C	dispidys is	time crew received requirement to execute a	Event nepart 1 DO
Variable intensity light.	Subsystem	mapped to	cognitive task (i.e., pian a tactical movement)	
		performance	Time required for the crew to complete cognitive	Event Report PDU
		of cognitive	task (i.e., plan and store a primary and alternate	
		tasks.	route)	
		Although Line	Danish and the Malaka and an animal and an animal and	(
		Attmongn nve	Pesignation of tigning system supporting the experiment	A (Manual Entry)
		lighting		
		system is the		
		best test.		
		Some form of		
		lighting		
		system is		
		it of direction		
		the simultor		
		during closed-		
		operations		
		which can		
		serve as a		
		precursor for		
		the		
		development		
		of the actual		
		lighting		
		system.		

## Subject of Experimentation/Testing. AFAS and FARV System Safety

- 2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment.
- Based on the results derived from the above matrix, DIS experimentation/testing appears feasible to assess the operational and technical tradewifs in AFAS and FARV specifications addressing the following areas: 2.1 Specifications supportable by DIS.
- Hazard alerts
- Crew warnings
- Crew cab lighting system
- experiment repeatedly altering hazard and crew warnings and crew cab lighting to determine operational and technical tradeoffs offered by alternative configurations. Installation of an actual C.3 Subsystem prototype in a FARV simulator provides the opportunity to experiment with various alerts, warnings, and lighting that produce optimum crew/force safety and crew efficiency. Placing AFAS and FARV simulators on a combined arms virtual battlefield permits evaluation of design changes that can be measured in terms of the battle outcomes at the conclusion of the experiment/scenario. Listed below are example battle statistics that testers/analysts may derive from the data elements in the above matrix to correlate experiment results to design changes in Sample Experiment. A single experiment/scenario in the DIS virtual environment can address each of the specifications in paragraph 2.1. Analysts and testers can run the same system safety:
- Number of fratricides resulting from the violation of fire support coordination measures and battlefield geometry based on C3 Subsystem warnings provided.
- Number of AFASs and FARVs sustaining combat damage and unscheduled maintenance based on hazard alerts and crew warnings activated during the experiment
- Crew time to complete cognitive tasks based on various lighting system configurations.
- Required Resources. To support experimentation and testing in the areas identified above the following resources are required:
- One AFAS crew to man an AFAS simulator

246

- One AFAS simulator complete with C3 Subsystem with BCC, 2 radios, intercom modems, crew stations, crew displays, supporting software.
- One FARV simulator and crew to support resupply operations.
- One LRP SAFOR and LRP controller to support FARV upload/download operations.
- One AFAS SAFOR and SAFOR controller to support senior to subordinate AFAS operations. FSATS could be upgraded to support digital messaging from a SAFOR Subordinate AFAS to a Senior AFAS manned simulator to support senior/subordinate howitzer operations
- One observer to acquire and submit calls for fire to engage opposition force targets on the virtual battlefield. FSATS could be employed as an alternative to generate calls for fire that drive a highly controlled scenario.
- One AFATDS POC computer operator to process the observer's call for fire. Another alternative is to upgrade FSATS POC node so that the FSATS POC may interface with AFAS and FARV. Testers could then embed the scenario in FSATS and allow the AFAS and FARV crews to interact with FSATS message traffic generated by the POC or observer nodes as appropriate.
- Threat SAFOR operations order and controller to execute order.
- Friendly force operations order with fire support coordination measures and battlefield geometry and controller to execute order.

Subject of Experimentation/Testing: AFAS Mobility.

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	a Collection Requirements

Specifications	Environments for Testing/	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Elements (X = Insupportable by DIS PDUs)
Vehicle Mobility				
AFAS Mobility Criteria	Live Test, Virtual	Average	Time movements started.	Entity state PDU
67 kph Sustained Speed Over Hard Surfaced	····	Speed >= 67	Time movements ended.	Entity state PDU
39 kph sustained speed cross country at a		April.	Distance between check points or start and stop points.	Entity state PDU
rolling resistance of 50 kg/torne		Average	Times/Speeds between firing points.	Event report PDU
		speed of 39	Type of suspension system employed	(I) <sub>X</sub>
			Type of automotive system employed.	X(1)
			Variables in the Automotive Subsystems.	X(1)
AFAS Mobility Criteria	Live Test, Virtual	Average	Time movements started.	Entity state PDU
max speeds Sustain 20 kph in Reverse Over Hard Surfaced		Speed >= 20	Time movements ended.	Entity state PDU
NOBIOS.		- April.	Distance between start and stop points.	Entity state PDU
			Types of Motive Power used.	Event report PDU
			Types of Rear Vision Devices used.	Event report PDU
AFAS Mobility Criteria	Live Test, Virtual	Average	Time movements started.	Entity state PDU
Maintain minimum tactical speeds on grades		speed >=	Time movements ended.	Entity state PDU
% to 60% (as defined below)65.0 kph 30%		speeds on	Distance between start and stop points.	Event report PDU
5%		same slopes.	Effects of Motive Power	Event report PDU

Subject of Experimentation/Testing. AFAS Mobility.

Specifications	Environments for	Measures of	Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs
	Testing	Performance	Collection if DIS Virtual Simulation is Appropriate	Required to Collect Data Elements
	Experimentation		Environment	(X = Insupportable by DIS PDUs)
AFAS Mobility Criteria	Live Test, Virtual	Decelerate	Time braking initiated.	Entity state PDU
10 M		maximum	Speed at time braking initiated.	Entity state PDU
		speed at an		
		average rate of	ime venicle stops.	Entity state PDU
		combat	Direction traveling at time braking initiated.	Entity state PDU
		weight.	Direction traveling when vehicle stopped.	Entity state PDU
		Side drift	Lateral drift distance	Entity state PDU and Event recort
		during stop not to exceed 2		PDU.
		meters per 15	Time elapsed between full stops.	Entity state PDU
		meters of	Number of full stone	Sortito etate POII
		travel.		
		Accomplish 25		
		stops at five		
	-	minute		
		80%		
		maximum		
		of 3.3 m/s2 at		
		ruil compat weight.		
AFAS Mobility Criteria	Live Test, Virtual	Average	Time movements started.	Entity state PDU
Must keep up with the maneuver forces.		between	Time movements ended.	Entity state PDU
		maneuver force area of	Distance between start and stop points.	Entity state PDU
		influence and AFAS area of	Times/Speeds between firing points,	Entity state PDU
		influence >=1.	Distance from FLOT during a battle, at each response to call for fire point.	Event report PDU
A BAC Mobility Criteria	Live Test Virtual	Average	The movements started	Rotity state PDI
Max Speeds		sustained		
Sustain Max Speed on 25mm root mean		speed =	Time movements ended.	Entity state PDU
		speed.	Distance between start and stop points.	Entity state PDU
			Times/Speeds between firing points.	Entity state PDU

Subject of Experimentation/Testing. AFAS Mobility .

	Environments for	Measures of	Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs
	I esting/ Experimentation	Pertormance	Collection if DIS Virtual Simulation is Appropriate Environment	Required to Collect Data Elements (X = Ineupportable by DIS PDUs)
AFAS Mobility Criteria Max Speeds	Live Test, Virtual	Average	Time movements started.	Entity state PDU
Sustain 64 kph over 38mm root mean square		Speed >= 64	Time movements ended.	Entity state PDU
		<u>.</u>	Distance between start and stop points.	Entity state PDU
			Times/Speeds between firing points.	Entity state PDU
			Type of suspension system employed	×
			Type of automotive system employed.	×
AFAS Mobility Criteria	Live Test, Virtual	Average	Time movements started.	Entity state PDU
men appears  Solito formation for the square		speed >= 40	Time movements ended.	Entity state PDU
		į	Distance between start and stop points.	Entity state PDU
			Times/Speeds between firing points.	Entity state PDU
AFAS Mobility Criteria Min Sustained Speed	Live Test, Virtual	Average	Time minimum speed initiated.	Entity state PDU
4 kph Creep Speed		speed <= 4	Time minimum speed terminated.	Entity state PDU
			Distance traveled between start and stop.	Entity state PDU
			Type of automotive power used.	Event report PDU
			Engine coolant temperature at start.	Event report PDU
			Engine coolant temperature at stop.	Event report PDU
			Maximum engine temperature during duration.	Event report PDU
			Maximum electric drive temperature between start and stop times if electric drives are used.	Event report PDU
AFAS Mobility Criteria Max Shock to Crew	Live Test, Virtual	Acceleration	Time positive vertical motion initiated.	X(1).
2. 5. Shock over 310 mm half round obstacle		than 2.5g	Time positive vertical motion ceased.	X(1).
			Vertical displacement of crew member's CG.	X(I).
			Time negative vertical motion initiated.	X(1).
,			Time negative vertical motion ceased.	X(II).
			Vertical displacement of crew member's CG.	X(I).

Subject of Experimentation/Testing. AFAS Mobility.

Specifications	Environments for	r	Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs
	Testing/ Experimentation	Performance	Collection if DIS Virtual Simulation is Appropriate Environment	Required to Collect Data Elements (X = Insupportable by DIS PDUs)
AFAS Mobility Criteria 2.5 G shock to crew over 410 mm half round	Live Test, Virtual	Acceleration on crew less	Time positive vertical motion initiated.	X(1).
obstacle at 16kph.		than 2.5g	Time positive vertical motion ceased.	X(1).
			Vertical displacement of crew member's CG.	X(1).
			Time negative vertical motion initiated.	X(1).
			Time negative vertical motion ceased.	X(1).
			Vertical displacement of crew member's CG.	X(1).
AFAS Mobility Criteria	Live, Virtual	Average	Time movements started.	Entity State PDU
Tactical mounity  Tactical Speeds		speed >=	Time movements ended.	Entity State PDU
Snow Dr		in table in first	Distance between start and stop points.	Entity State PDU
			Times/Speeds between firing points.	Entity State PDU
		· · ·	Type terrain.	Event report PDU
			Type soil/surface condition.	Event report PDU
AFAS Mobility Criteria Pording 122 cm Max Depth, Hard Bottomed Streams.	Live Test	<del>                                     </del>	Vehicle displacement when empty. i.e will the vehicle float/drift when only a few gallons of fuel remain on-board and everything else is empty.	X(1).
		depth (122 cm) without losing	Velocity of stream/river being crossed.	X(1).
		control	Lateral stip/drift (if any).	X(1).
AFAS Mobility Criteria Fording Entrance and Exit Slopes of up to 40%	Live Test, Virtual	Vehicle crosses ford without dragging or damaging tube	Distance between banks. Width of ford. Length of ford.	Event report PDUs can report the terrain data carried locally in the host.
		Vehicle enters and exits ford with	Bank height. Minimum ground-tube clearance.	X <sub>(1)</sub> ,
		slopes without	maximum  Spes without Vehicle Geometry.	X(1).
		directional control or taking on water.	Additional approach and departure slopes.	Event report
		Water.		

Subject of Experimentation/Testing. AFAS Mobility.

	l esting Experimentation	Performance	Collection if DIS Virtual Simulation is Appropriate Environment	Required to Collect Data Elements (X = Insupportable by DIS PDUs)
/ Criteria	Live Test, Virtual	Vehicle	Vehicle Geometry	X(1).
2.5 meter Capability in the Forward Direction.		it ig/dam ube	CG changes with various armament, propellant and fuel loads.	Event report PDUs can report the terrain data carried locally in the host.
			Approach and departure stopes.	Event report PDU
			Distance from obstacles that slopes begin and end.	Event report PDU
AFAS Mobility Criteria	Live Test, Virtual	Vehicle	Vehicle Geometry, tube ground clearance.	X(1).
91 cm. 91		without	CG changes with armament and fuel loads.	X(1).
		ළ	Approach and departure slopes.	Event report PDUs can report the terrain data carried locally in the host.
			Distance from obstacle that slopes begin/end.	X(1).
AFAS Mobility Criteria Tuming Ability	Live Test	Lateral	Time turn started.	X(1).
0.7 grammers on dry pavement at 20% to 100% of			Speed of vehicle at start and end of turn.	χ(I).
	_	speed ranges	Time turn stopped.	X(1).
			Radius of turn.	X(1).
AFAS Mobility Criteria Lateral Slope	Live Test	Successfully cross a slope of	Slope crossing capabilities with varying loads and associated centers of gravity.	X(1).
Capability		ndicular fall line.	Slope being traversed (in %)	Event report PDUs can report the serrain data carried locally in the host.
			Weight of the vehicle.	Entity state PDU
			Vehicle Center of Gravity	X(1).
			Maximum speed achieved on the slope.	Entity state PDU

Subject of Experimentation/Testing. AFAS Mobility.

Specifications	Environments for		Characteristics and Their Data Elements for	Edeting, Modified, or New DIS PDU.
	Testing/ Experimentation	Pertormance	Collection if DIS Virtual Simulation is Appropriate Environment	Required to Collect Data Bernessa (X = Insupportable by DIS PDUs)
AFAS Mobility Criteria Longitudinal Slope	Live Test		Slope climbing capabilities with varying loads and associated centers of gravity.	X(1).
60% Maximum Slope Climbing Capability		slope, parallel to the fall line	Slope being climbed (in %)	Event report PDUs can report the
		while sustaining a		terrain data carried locally in the host.
		5 mph	Weight of the vehicle.	Entity state PDU
		velocity.	Maximum speed achieved on the slope.	X(1).
AFAS Mobility Criteria	Live Test	Maintain a	Average sustained uphill speeds for similar slope.	X(1).
Maintain downhill speeds not greater than	•	speed that is	Engine temperature at start and end of slope.	X(I).
upnill speeds on long primary road grades of up to 15%. See table below.		or less than	Time started down slope.	Event report PDU
. !		speed of the	Time arrived at bottom of slope.	Event report PDU
5%		vehicle without the	Engine temperature at bottom of slope.	Kri
15%23.7 kph		use of brakes		
		the engine overheating.		
AFAS Mobility Criteria	Live Test, Virtual	360 degree	Location of start of turn.	Bntity state PDU
500 Degree turn within 1.5 times the chassis		completed	Periodic locations during the turn.	Entity state PDU
rengin.		with a radius	Location at the end of the turn.	Entity state PDU
		the vehicle	Swept area of the tube during the turn.	Entity state PDU
		Chassis lengul.	Trafficability in Cities.	×
			Mobility in Wooded and constricted terrain.	×

Subject of Experimentation/Testing. AFAS Mobility.

Specifications	Environments for Testing/	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate	Existing, Modified, or New DIS PDUs Required to Collect Data Elements
AFAS Mobility Oribers	Live Test	Vehicle	RCI for soil.	X(4)
Vehicle Cone Index 26.6 or less for a single pass on fine grained soil.		crosses soil with RCl >= 26.6 and becomes	Time vehicle entered soft soil area.	Event report PDUs can report the terrain data carried locally in the heat.
		mired in soil with a RCI of	Time vehicle departed the soft soil area.	Event report PDU
		.6.20.0.	Minimum speed in the soft soil area.	Entity state PDU
			Did the vehicle stop?	Event report PDU
			Trafficability and track footprint.	X(1).
			Wheel type and wheel base.	X(1).
			Automotive technology: Electrical or Conventional	X(1).
AFAS Mobility Criteria	Live Test	Vehicle does	Speed of vehicle prior to beginning of braking.	X(1), Entity state PDU
1 meter maximum lateral drift per 30 meters		or does not stop within	Location of vehicle at the beginning of braking.	X(1). Event report PDU
IOTWALD HAVE		limits stated.	Location of vehicle at the end of braking.	X(1). Entity state PDU
AFAS Mobility Criteria	Live Test	Vehicle does	Slope at the vehicle's location (in %)	Event report PDU
orar and Operate. On all traversable slopes.		start on the	Time engine start initiated.	Entity state PDU
		specined slopes.	Time engine started.	Entity state PDU
AFAS Mobility Criteria	Live Test	Vehicle does	Time engine began idling.	Entity state PDU
ruei Economy 15 kg/hr at idle, maximum.		attain the	Time engine stopped idling.	Entity state PDU
		economy	Amount of fuel consumed during idling period,	X(1).
		specified conditions.		
AFAS Mobility Criteria	Live Test	Vehicle does	Time travel started.	Entity state PDU
Onrerueled Kange 405 km at 47 mph		achieve the	Amount of fuel on-board at start.	Entity state PDU
		specined range under the	Time travel ended.	Entity state PDU
		specified conditions.	Distance vehicle traveled.	Entity state PDU

Subject of Experimentation/Testing. AFAS Mobility.

Specifications	Environments for Testing/ Experimentation	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Ediating, Medified, or New DIS PDUs Required to Collect Data Elements (X = Insupportable by DIS PDUs)
AFAS Mobility Criteria Refuel Rate 132 liters per minute	Live Test	Vehicle does or does not achieve the	Time refueling started. Time refueling ended.	Entity state PDU Entity state PDU
		refueling rate under the specified conditions.	Total number of liters of fuel transferred.	Resupply received PDU
AFAS Mobility Criteria	Live Test	Vehicle does	Time refueling started.	Entity state PDU
כסוולוביביל ובותבובים אינוווון ד וווווחובים		achieve the	Time refueling ended.	Entity state PDU
		refueling rate under the specified conditions.	Total number of liters of fuel transferred.	Entity state PDU
AFAS Mobility Criteria Vehicle Mobility Subsystems: Track and Suspension	Virtual	Vehicle Performance Measurement	Vertical and lateral accelerations on crew and equipment with different type of track and suspension elements	X(1). Event report PDUs could be used for data collection.
		<u> </u>	Vehicle speed.	Entity state PDU
			Obstacle height.	X(1).
			Obstacle cross section.	X(1).
			Vertical displacement of crew member's CG.	X(1).
			Vertical displacement of vehicle's CG	X(1).
AFAS Mobility Criteria	Virtual	Vehicle	Acceleration.	Entity state PDU.
Venicle Modulity Subsystems: Propulsion System		with diesel	Hill climbing capability	Entity state PDU
		power.	Sustained speeds with different types of propulsion	X(1).
		performance with electric	sýstems.	
		power.		

Subject of Experimentation/Testing. AFAS Mobility.

Specifications	Environments for Testing	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate	Edisting, Modified, or New DIS PDUs Required to Collect Data Elements
	Experimentation		Environment	(X = Insupportable by DIS PDUs)
AFAS Mobility Criteria	Live, Emulations	Do all critical	Test vehicle systems that are electrically powered.	X(1).
Auxiliary Power Source		remain	Battery type sources.	x(1):
		operational	•	
		under all	Fuel Cell Sources.	X(II).
		abnormal	Auxiliary Generator Sources.	X(1).
		operations.	Commercial Power Sources.	X(1).
			Provide/accept power to/from other vehicles.	X(1).
AFAS Mobility Criteria	Emulations, Virtual		Vary power usage conditions.	×
Vencie Subsystems: Power Management		remain	Wattage required for full operation.	X(1).
		under all	Wattage required for each electrical component.	×
		abnormal operations.	Wattage capability of on-board primary and auxiliary power generation systems.	X(I).
			Wattage required for degraded operations.	×
			Determine time spent managing power and applicability of automation	X(1).
Vehicle Subsystems: Interior and Exterior Lighting.	Emulations, Virtual	-	Vary location and intensity of internal and external lighting.	×
		adequate for all operations	Collect data on crew performance of several different X(1), tasks while using each lighting configuration.	X(1).
		in each likely crew compartment configuration.	Collect data on security compromises under operational conditions with each lighting configuration.	X(1).
Vehicle Subsystems: Upload of Puel	Live, Emulation	Can fuel be safely	Collect refueling rates for each of the following combinations:	X(1).
		uploaded under all	Positive Pressure, Push Fuel;	×
		abnormal	Negative Pressure Pull Fuel;	×
		operating conditions.	Combination	×

Subject of Experimentation/Testing. AFAS Mobility.

Specifications	Environments for	Measures of	Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs
	Testing	Performance	Collection if DIS Virtual Simulation is Appropriate	Required to Collect Data Blements
	Experimentation		Environment	(X = Insupportable by DIS PDUs)
ystems:	Live, Emulations	Can fuel be	Positive Pressure, Push Fuel;	×
Fuel Storage		safely stored		
		under all	Negative Pressure Pull Fuel;	×
		aboormal	Combination	>
		operating		•
		conditions.		
lems:	Live, Emulations	Can fuel be	Collect safety data and crew task loading, for each of	X(1).
		safely handled	the following combinations:	
		under and normal and	Positive Pressure, Push Fuel;	×
		abnormal	Monetine Described Bull End.	3
		operating conditions.	Negative Pressure, Full Fuel;	×
			Combination	×
			Manual upload and download times.	X(1).
No Spillage	Live, Emulations	Can fuel be transferred	Measure spillage, if any, while using the following fuel transfer processes:	×
		excessive	Positive Pressure, Push Fuel;	×
		abinida a binida	Measure amount of fuel spilled.	×
			Negative Pressure Pull Fuel;	×
			Combination	×
			Manual processes.	×
No Contamination	Live, Emulations	Can fuel be transferred	Measure contamination, if any, while using the following fuel transfer processes:	×
		contaminatio	Positive Pressure, Push Fuel;	×
			Negative Pressure Pull Fuel;	×
			Combinations	×

Subject of Experimentation/Testing. AFAS Mobility.

Specifications	Environments for		Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs
	Testing/ Experimentation	Performance	Collection if DIS Virtual Simulation is Appropriate Environment	Required to Collect Data Elements (X = insupportable by DIS PDUs)
Vehicle Subsystems: FARV Sunnort and Transport Systems	Virtual	Can the AFAS provide	Can the PARV be attached to the AFAS?	×
		to the	Can the AFAS tow the FARV at the required speeds for the required distances?	×
		FARV when the FARV is	Can the AFAS provide adequate auxiliary power to	×
		Unable to do so itself.	the FARV to enable the operation of all of the FARV communication systems. NBC protective systems.	
			fuel and ammunition transfer systems and provide adequate power for its own systems.	
AFAS Support and Transport Systems	Live	Can the AFAS	Can the AFAS Can the AFAS be attached to the FARV?	×
		a	Can the AFAS tow the FARV at the required speeds for the required distances?	×
		the FARV is	Can the AFAS provide adequate auxiliary power to the FARV to enable the operation of all of the FARV	×
		so itself.	communication systems, NBC protective systems, fuel and ammunition transfer systems and provide adequate power for its own systems.	
Tool Sets	Live		Retrieve, assemble and use tool sets in different configurations and storage	χ(ι)
Rail Systems	Live		Ability to position the vehicle with different methods and degrees of visibility.	X(1)
			Time loading started.	χ(I)
			Time vehicle in position for tie-down.	X(1)
Highway Freight Systems	Live		Ability to position the vehicle with different kinds and degrees of visibility	X(1)
			Time loading started.	X(1)
			Time vehicle in position for tie-down.	X(1)
Sea Transport Systems	Live	Can the vehicle be transported by sea transport.		

## Subject of Experimentation/Testing. AFAS Mobility.

Specifications	Environments for Testing/ Experimentation	Measures of Performance	nts for Measures of Characteristics and Their Data Elements for Existing, Modified, or New DIS PD  Performance Collection if DIS Virtual Simulation is Appropriate (X = Insupportable by DIS PDUs)	Existing, Modified, or New DIS PDUs Required to Collect Data Elements (X = Insupportable by DIS PDUs)
AFAS Support and Transport Systems	Live		Ability to provide maintenance support to the AFAS X(1) and to be able to tow the AFAS to the maintenance facility.	(I)
Tool Sets	Live			
Towing Equipment	Live			

X(1). Note: DIS Simulation could provide an appropriate environment for testing and evaluation, however data on the DIS network would not generally support the measurements needed.
2. Technical and Operational Benefits of Vehicle Mobility Experimentation in DIS Virtual Environment.

Stated specifications. Based on the results derived from the above matrix, DIS experimentation appears feasible in assessing the operational and technical tradeoffs in the following AFAS: requirement to keep up with the maneuver forces: 7.7

Must keep up with the maneuver forces

Maximum speeds for the vehicle.

Sustained speed of 67 kph on hard surfaced roads.

39 kph sustained speed cross country.

20 kph sustained speed, in reverse, over hard surfaced roads. Maintain minimum tactical speeds on uphill and downhill grades of 2% to 60%.

Braking.

Minimum speeds for the vehicle

4 kph Creep Speed.

Crew environment.

Maximum of 2.5 G road shock transmitted to crew.

Maintain maximum speed on 25 mm root mean square terrain.

Maintain a minimum speed of 64 kph over 38 mm root mean square terrain. Maintain a minimum speed of 40 kph over 51 mm root mean square terrain.

At maximum speed, traversing a 310 mm half round obstacle. At 16 kph, traversing a 410 mm half round obstacle.

Terrain Mobility

Fording: Entrance and Exit Slopes of up to 40%

Climbing: 91 cm Vertical Obstacle in the Forward Direction. Gap crossing capability of 2.5 meters in the forward direction. 40% slope traversing capability. 60% slope climbing capability.

360 degree turn within a radius of 1.5 times the chassis length

Vehicle Mobility Subsystems:

Track and Suspension. Propulsion System.

Auxiliary Power Source. Power Management.

2.2 Other Aspects of Performance Measurable in a DIS Virtual Environment. The sub-elements listed under paragraph 2.1 can be assessed individually.

- vehicle weight and other mechanical losses provide the rolling resistance. If the components are modeled in high fidelity, then the effects of each component can be determined and outputs. The transmission emulation accepts the power output of the engine, subtracts applicable losses and provides the resultant power to the final drives. The final drives accept resistance, slope, obstacles, etc. from a terrain file and provides amount power output, excess power available, thermal efficiency, engine temperature, fuel consumption rates, etc. as the power output of the transmission, subtracts losses and provides the resultant power to the sprocket, which turns the tracks, and finally, moves the vehicle. Soil characteristics, Sustained speeds of at least 67 kph over hard surfaced roads. A set of integrated modules of simulated systems for the AFAS must be developed to support this as well as other someplace like the Waterways Experiment Station (WES), U.S. Army Corps of Engineers, Geotechnical Laboratory, Analytical Studies Branch. If these modules are developed in software, as objects, they can be reused in other applications. In addition to the automotive system, a suspension system consisting of road wheels, torsion bars, springs, or other electro-mechanical shock absorbing devices. The simulated engine accepts throttle position from the crew cab; fuel type, ambient temperature, etc. from a attribute file; rolling tests. The set of modules must include an automotive system consisting of an engine, transmission, final drive unit, sprockets, tracks and track pads or a system consisting of engine, generator, electric traction motors, sprockets, tracks and track pads or hybrids containing components of either system. These modules may already exist, in a library experimented with to provide the optimum mix of power and suspension that can still meet the criteria to maintain a minimum speed of 67 kph over hard surfaced
- Sustained speeds of at least 39 kph over level cross country terrain where the rolling resistance does not exceed 90 kg per tonne of vehicle weight. The model engine, transmission, final drives, sprockets, tracks, and track pads must be modeled, as described above.
- Sustain 20 kph, in reverse, over hard surfaced roads. The main emphasis of this testing would be to determine what vision and steering devices that the crew/driver need enable them to keep the vehicle on the road while sustaining the specified speed. e,
- Vehicle Speeds. Maintain the minimum specified speeds, both in the uphill and the downhill direction. The emphasis of this testing would to determine the specifications for the engine, transmission and brakes that would be needed to satisfy the requirements as well as determine the overall impact on the requirement to keep up with the maneuver
- Braking. Decelerate from maximum speed at an average rate of 5 m/s<sup>2</sup> at full conibat weight. The emphasis of this testing would to determine the specifications for the engine, transmission and brakes that would be needed to satisfy the requirement. 'n
- Vehicle Suspension. The vehicle suspension must safely carry the vehicle and its crew over terrain of specified roughness at least at the specified speeds withou texceeding the vehicle or crew shock limits. The emphasis of the testing would be to determine if the suspension system for the vehicle and crew positions could perform as required for all combinations of vehicle weights, centers of gravity, tactical speeds, size and shapes of obstacles, etc.
- 7. Creep Speed. Sustain a creep speed of 4 kph without engine overheat. Emphasis of this testing is to determine if the automotive system has enough excess cooling capacity to provide adequate cooling while moving at a much slower than normal pace for sustained periods of time. Conducting the experiment in a synthetic environment will allow testing under a wide range of environmental conditions.
- depth, is how the overhang of the gun tube and its associated pendulum effect, in conjunction with various entrance and exit bank slope configurations and suspension options will AFAS Fording criteria. The vehicle must be able to ford streams. A major area of interest, other than the simple ability to drive through water that is at or below the specified affect the fording capability and its associated freedom of cross country movement. Will there be any combinations that cause the tube to drag or dig into the rear bank or slopes while still falling within the fording depth and entrance and exit slope criteria?
- 9. AFAS Gap Crossing Criteria. The vehicle must be able to "self-bridge" small gaps of at least 2.5 meters width, at least while it is traveling in the forward direction. The ability to cross gaps is dependent in part on the center of gravity and the vehicle suspension. Both parameters could be altered incrementally to observe the effects on the requirement each of the variables has on all combinations of operational loads.
- overhang of the gun tube and its associated pendulum effect, in conjunction with various obstacle approach and departure slope configurations and suspension options will affect the vehicle's capability to overcome obstacles and its associated freedom of cross country movement. Will there be any combinations that cause the tube to drag or dig into the rear Vertical Step/Obstacles. The vehicle must be able to overcome vertical obstacles. A major area of interest, other than the simple ability to drive over an obstacle, is how the bank or slopes while still falling within the obstacle height and approach and departure slope criteria? 5
- combination of total vehicle weight, center of gravity, speed, and vehicle suspension. With accurate models, the virtual vehicle can try out different combinations of suspensions The ability to accomplish these turns will depend on a Vehicle Comering Ability. The vehicle must have the capability to make sharp turns at all operational speeds. and combat loads to determine if there will be any unexpected results, like loss of control or overturning?

#### 12. Slope Crossing and Climbing

### Subject of Experimentation/Testing. AFAS Mobility.

- Cross 40% slope. The vehicle must have the capability to traverse hard surfaced slopes of up to 40% at all operational speeds. The ability to accomplish traverse these slopes will depend on a combination of total vehicle weight, center of gravity, speed, and vehicle suspension. With accurate models, the virtual vehicle can try out different combinations of suspensions and combat loads to determine if there will be any unexpected results, like loss of control or overturning.
- and descend slopes of up to 60%. The ability to climb and descend these slopes depends on total With accurate models, the virtual vehicle can try out different combinations of suspensions and Climb and descend 60% slopes. The vehicle must have the ability to climb and descend slopes of up to 60%. combat loads to determine if there will be any unexpected results, like loss of power or loss of forward motion. vehicle weight, center of gravity, suspension and automotive power system.
- c. Start engine and operate on all slopes. The vehicle must have the ability to start engines on all slopes up to 60%, while facing whether the uphill or downhill. With accurate models, the virtual vehicle can try out different combinations of suspensions and combat loads to determine if there will be any unexpected results, like loss of engine starting ability on certain slopes.
- pendulum effect, in conjunction with various tree densities and stem heights in forests, or city street widths and corners in built-up areas, will affect the maneuvering capability of Pivot Steer Clearances. An area of interest, other than the simple ability to turn the vehicle in a 360 degree, tight circle, is how the overhang of the gun tube and its associated the vehicle and its associated freedom of movement and choire of routes. What situations will cause the overhang of the main gun tube to be the limiting factor to movement? €
- tracks at differing loads and speeds in synthetic operational environments to determine if there will be any unexpected results, like loss of traction or excessive scarring of the soil. Soft Soil Crossing Capability. With accurate models, the virtual vehicle can try out different combinations of vehicle centers of gravity, automotive power, suspensions and Soil and automotive models upon which to build the simulation may already exist at WES. 7
- Unrefueled Range. With accurate models, the virtual vehicle can try out different combinations of automotive power, suspensions and tracks at differing loads and speeds in synthetic operational environments to determine if there will be any unexpected results in fuel consumption, which in-turn will affect the range of the vehicle. 5
- rate) allow the vehicle to perform continuous operations for a 48 to 96 hours? Under what conditions, i.e. distances between resupply points, vehicle speeds, soil conditions, slopes, transfer the fuel at a rate that will completely refuel the vehicle in two minutes. In operational scenarios, will these two refueling requirements (a minimum rate and a maximum Refueling Rates. There are two requirements that must be tested. The first is the vehicle's ability to transfer fuel at a minimum rate of 132 liters per minute. The second is to number of resupply opportunities, etc. will the minimum or maximum refueling rates be insufficient to maintain the current operational pace.
- Track and Suspension Subsystems. Different suspension models can be mated with chassis to determine if that particular design can meet the operational requirements by performing standard operational scenarios.
- 18. Propulsion System. Different propulsion system models can be mated with chassis and suspension to determine if that particular design can meet the operational requirements performing standard operational scenarios
- 19. Auxiliary Power Sources. Different auxiliary power system models can be mated with chassis and suspension to determine if that particular design can meet the operational requirements by performing standard operational scenarios.
- power within the vehicle. Experiment with a range of automation under operational conditions. Experiment with a wide range of possible power sources and their associated shurt Power Management. Different auxiliary power system models can be employed with different vehicle systems architectures to determine the most useful methods of managing comings, i.e. commercial power and voltage sags and spikes, battery power and low voltage conditions, portable generator power and line noise, etc. Determine the impact of various power sources and their suitability on the accuracy, safety, and reliability of vehicle systems.
- Interior and Exterior Lighting. Use the simulator and/or a virtual vehicle to determine the best locations and types of external and internal lighting. Employ the vehicle in the synthetic environment to determine the operational impacts of having or not having lighting.
- turn to examine its effect on the ability of the AFAS to keep up with the maneuver force. First, create an AFAS full size, functional crew cab and a mathematical model that can represent the rust 2.3 Sample Experiment. The key requirement in the above specifications is for the AFAS to keep up with maneuver forces. Most of the other requirements are enablers that allow the AFAS to meet that one requirement. The ability of the AFAS to keep up with the maneuver force can be evaluated in the DIS environment. Each of the supporting enablers can be varied in experiment is to determine if the AFAS can respond to all requests for fires, conduct rearm as required under all conceivable weather conditions and still maintain the same relative distance of the AFAS and its systems. Place the AFAS in a DIS combat scenario. Run the scenario, and monitor the position of the AFAS in relation to the maneuver force. The objective of the from the maneuver forces as it was at the beginning of the scenario, regardless of terrain and number of fire missions received.

### Subject of Experimentation/Testing. AFAS Mobility

- . Place the crew in the crew cab of the AFAS simulator.
- . Place the simulator inside the DES environment
- 3. Execute a series of standard scenarios, with the primary variable being the speed of advance of the maneuver force.
- 4. Have the crew "drive" the AFAS through the synthetic environment, moving as directed by HHQ and responding to calls for fire.
- 5. Collect data to determine the difference in the distance between the maneuver force and the location of the FAS each time the AFAS receives a call for fire.
- Vary the synthetic environment and redo the tests using the same scenario. Make the air temperature hotter or colder and see if the automotive system can handle it.

Vary the automotive components, the fuel, the rearm times, etc. and see what effects the changes have on the ability of the AFAS to keep up with the maneuver unit.

- 3. Required Resources. To support experimentation and testing in the areas identified above, the following resources are required:
- 1. One AFAS crew to man an AFAS simulator crew cab.
- One AFAS crew compartment and associated simulator interfaces, equipped with BCC, radios, modems, crew stations, crew displays, supporting software, with access to M712 Copperhead rounds in the ammunition storage area
- 3. One AFAS emulation system to stimulate the crew interfaces in the simulator and provide, either directly or indirectly, vehicle performance data to the DIS environment. The requirements for the emulator(s) are discussed in more detail in paragraph 4, below.
- 4. A target acquisition system and fire control to acquire targets and submit calls for fire to engage targets on the virtual battlefield.
- 5. One fire direction computer operator
- 6. One AFATDS POC computer to process the observer's call for fire during centralized AFAS operations, automatically relay calls for fire during decentralized operations, and update AFAS information base on fire support coordination measures and battlefield geometry, meteorological data, and preplanned targets.
- 7. One AFAS SAFOR to support senior to subordinate AFAS operations
- 8. Threat SAFOR operations order
- 9. Threat SAFOR to execute the order
- 10. Friendly force operations order with fire support coordination measures and battlefield geometry
- 11. Friendly SAFOR to execute the order
- 4. Emulators Required. The following models or emulations will be needed to support the AFAS simulator.
- 1. Primary automotive emulation packages consisting of models representing an engine/generator and transmission/electric drive unit and final drives/sprockets.
- 2. Primary chassis and suspension emulation packages consisting of models representing springs/torsion bars, road wheels, tracks and track pads
- 3. Chassis model (in software) consisting of chassis, turret, gun tube, crew cab, etc. Primary interest in the DIS testing is in the chassis-gun tube configuration.
- 4. Auxiliary power system consisting of primary and auxiliary generator, storage batteries, auxiliary hydraulic pump, auxiliary fuel pump, auxiliary propellant pump, materials

Subject of Experimentation/Testing. AFAS Mobility.

5. Power management system consisting of appropriate power sources, and control devices. Some of the devices may be crew accessible inside the simulator and will require a high fidelity emulation.

Subject of Experimentation/Testing: FARV Mobility Criteria

1. Data Collection Requirements

-	Entity state PDU	Entity state PDU	Entity state PDU	Event report PDU	Event report PDU	Event report PDU	Event report PDU	Entity state PDU	Entity state PDU	Entity state PDU	Event report PDU	Event report PDU	Event report PDU	Event report PDU	Entity state PDU	Entity state PDU	Event report PDU
Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Time movements started.	Time movements ended.	Distance between start and stop points.	Times/Speeds between firing points.	Type of suspension system employed	Type of automotive system employed.	Variables in the Automotive Subsystems.	Time movements started.	Time movements ended.	Distance between start and stop points.	Times/Speeds between firing points.	Type of suspension system employed.	Type of automotive system employed.	Types of Rear Vision Devices	Time movements started.	Tin vements ended.	Distance between start and stop points.
Measures of Performance	Average	Speed >= 67	į	Average	2	speed of 39 kph		Average	2.	<u>.</u>		<u> </u>			Average	Speed	
Environments for Testing/ Experimentation	Live Test, Virtual							Live Test, Virtual							Live Test, Virtual		
Specifications	FARV Mobility Criteria Max Speeds	67 kph Sustained Speed Over Hard Surfaced	Di Lah	59 Kpii sustained speed cross coming at a rolling resistance of 90 kg/tonne				FARV Mobility Criteria	20 kph Sustained Speed in Reverse Over Hard	United Notice					FARV Mobility Criteria	Minimum acceptable speeds on grades of 2% to 60% (as defined below)	2%—65.0 kph 30%—13.5 kph 5%—47.4 kph 40%—9.5 kph 10%—23.0 kph 50%—8.3 kph 15%—23.7 kph 60%—7.0 kph 20%—19.5 kph

Subject of Experimentation/Testing: FARV Mobility Criteria.

	,	,		11301 213
Specifications	Testing/	Performance	Collection if DIS Virtual Simulation is Appropriate	Extering, Modified, of New Dis Public Required to Collect Data Elements
	Experimentation		Environment	(X = Insupportable by DIS PDUs)
Braking	Live Test, Virtual	Average	Time braking initiated.	Entity state PDU
			Speed at time braking initiated.	Entity state PDU
	-	maximum speed at 5	Time vehicle stops.	Entity state PDU
		m/s <sup>2</sup> . at full	Direction traveling at time braking initiated.	Entity state PDU
		weight.	Direction traveling when vehicle stopped.	Entity state PDU
		Side drift	Lateral drift distance.	X(1). /Entity state PDU and Event
		not to exceed 2		report PDU.
		meters in 15 meters of	Time between full stops.	Entity state PDU
		travel.	Number of full stops.	Entity state PDI
		Accomplish 25		Elliny state 1 DO
		consecutive		
		minute		
		80%		
	·	maximum speed at a rate		
		of 3.3 m/s2 at full combat weight.		
FARV 1. Sility Criteria	Live Test, Virtual	Average	Time movements started.	Entity state PDU
		between the	Time movements ended.	Entity state PDU
mant orces.			Distance between start and stop points.	Entity state PDU
		points.	Times/Speeds between firing points,	Entity state PDU
			Distance from AFAS during a battle, at each response to call for resupply.	Event report PDU
FARV Mobility Criteria May Speed on 25mm and mean equate persain	Live Test, Virtual	Average	Time movements started.	Entity state PDU
יייין איניין		Speed =	Time movements ended.	Entity state PDU
		Speed	Distance between start and stop points.	Entity state PDU
			Times/Speeds between rearm and resupply points.	Entity state PDU

Subject of Experimentation/Testing: FARV Mobility Criteria.

Specifications	Environments for Testing/	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Reviewment	Existing, Modified, or New DIS PDUs Required to Collect Data Elements OX = Insurportable by THE PONIA
FARV Mobility Criteria	Live Test, Virtual	Average	Time movements started.	Entity state PDU
64 kph over 38 mm root mean square pronte terrain		Speed >= 64	Time movements ended.	Entity state PDU
		rpn	Distance between start and stop points.	Entity state PDU
			Times/Speeds between rearm and resupply points.	Entity state PDU
			Type of suspension system employed	Event report PDU
			Type of automotive system employed.	Event report PDU
FARV Mobility Criteria	Live Test, Virtual	Average	Time movements started.	Entity state PDU
40 kph over 51mm root mean square profile terrain		Sustained Speed >= 40	Time movements ended.	Entity state PDU
		w dw	Distance between start and stop points.	Entity state PDU
			Times/Speeds between rearm and resupply points.	Entity state PDU
			Type of suspension system employed	Event report PDU
			Type of automotive system employed.	Event report PDU
FARV Mobility Criteria Min Sustained Speed	Live Test, Virtual	Average	Time minimum speed initiated.	Entity state PDU
4 kph Creep Speed		Speed >= 4	Time minimum speed terminated.	Entity state PDU
		:	Distance traveled between start and stop times.	Entity state PDU
			Type of automotive power used.	Event report PDU
			Engine coolant temperature at start	Event report PDU
			Engine coolant temperature at stop	Event report PDU
	_		Maximum engine temperature during duration.	Event report PDU
			Maximum electric drive temperature between start and stop times if electric drives are used.	Event report PDU.

Subject of Experimentation/Testing: FARV Mobility Criteria.

Specifications	Environments for	Messures of	Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs
	Testing/ Experimentation	Performance	Collection if DIS Virtual Simulation is Appropriate Environment	Required to Collect Data Elements (X = Insupportable by DIS PDUs)
FARV Mobility Criteria	Live	Acceleration	Time positive vertical motion initiated.	X(1).
character to crew over 310 mm half round		than 2.5g	Time positive vertical motion ceased.	X(1).
			Vertical displacement of crew member's CG.	X(1).
			Time negative vertical motion initiated.	X(1).
			Time negative vertical motion ceased.	X(1).
			Vertical displacement of crew member's CG.	X(1).
FARV Mobility Criteria	Live	Acceleration	Time positive vertical motion initiated.	X(1).
Max Shock to Crew School to crew over 410 mm half round		than 2.5g	Time positive vertical motion ceased.	X(1).
COSTALIC AL TO A DIL			Vertical displacement of crew member's CG.	X(1).
			Time negative vertical motion initiated.	X(1).
			Time negative vertical motion ceased.	X(1).
			Vertical displacement of crew member's CG.	X(1).
FARV Mobility Criteria	Live, Virtual	Average	Time movements started.	Entity State PDU
factical Modulity  Tactical Speeds		Speed as	Time movements ended.	Entity State PDU
		the table in	Distance between start and stop points.	Entity State PDU
24 kph 18 kph 20 kph 28 kph 27 kph 22 kph		column	Times/Speeds between resupply and rearm points.	Entity State PDU
			Type terrain.	Event report PDU
			Type soil/surface condition.	Event report PDU
FARV Mobility Criteria Tactical Mobility Fording 122 cm May Denth Hard Rottomed Streams	Live Test	Vehicle crosses ford at maximum	Vehicle displacement when empty. I.e., will the vehicle float when only a few gallons of fuel remain on-board and everything else is empty.	X(1).
	-	losing	Velocity of stream/river being crossed.	X(1).
		control	Lateral slip/drift (if any).	X(1).

Subject of Experimentation/Teating: FARV Mobility Criteria.

Specifications	Environments for	Measures of	Characteristics and Their Data Elements for	Exieting, Modified, or New DIS PDUs
,	Testing/ Experimentation	Performance	Collection if DIS Virtual Simulation is Appropriate	Required to Collect Data Blements (X = Incorporately by D15 PDI in)
FARV Mobility Criteria	Live Test	Vehicle enters	Vehicle Geometry.	×
Tactical Mobility				
Fording		with	CG changes with armament and fuel loads.	×
Entrance and Exit Slopes of up to 40%		maximum		
		slopes without	slopes without Entrance and exit slopes.	Event Report
		directional	Distance from edge of the ford that slopes begin/end.	×
		control or		·
		taking on		
		water.		
FARV Mobility Criteria	Live Test	Vehicle	Vehicle Geometry.	X(1).
Lactical Mobility		crosses	CC changes with armament and fine loads	Cross to a DOI to any at the
2.5 meter Capability in the Forward Direction.		becoming		terrain data carried locally in the
		trapped or		host.
		directional	Approach and departure slopes.	Event report PDU
		control.	Distance from obstacle that slopes begin/end.	Event report PDI
FARV Mobility Criteria	Live Test	Vehicle	Vehicle Geometry.	X(1).
Tactical Mobility		crosses		
Obstacles		Without losing	CC changes with armament and fuel loads.	X(1).
Direction.		control or	Approach and departure slopes.	Buse femore DOI is one second the
		forward		terrain data carried locally in the
		velocity.		hoet.
			Distance from obstacle that slopes begin/end.	X(1).
			:	
FARV Mobility Criteria Tactical Mobility	Live Test		Quick turning capabilities with varying loads and associated centers of gravity.	
Turning Ability		on crew less	· -	
0.7 g Turns on dry pavement at 20% to 100% of		than 0.7g in	Time turn started.	x(1).
		specified.	Speed of vehicle at start and end of turn.	X(1).
			Time turn stopped.	X(I).
			Radius of turn.	X(1).

Subject of Experimentation/Testing: FARV Mobility Criteria.

Specifications	Environments for Testing/ Experimentation		Characteristics and Their Data Blements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Elements (X = Insupportable by DIS PDUs)
FARV Mobility Criteria Tactical Mobility Lateral Slope Traversibility	Live Test	Successfully cross a slope of 40%.	Successfully Slope crossing capabilities with varying loads and cross a slope of associated centers of gravity.	X(1).
40% Maximum Lateral Slope Crossing Capability	-	ndicular fall line	Slope being traversed (in %)	Event report PDUs can report the terrain data carried locally in the host.
			Weight of the vehicle.	Entity state PDU
			Vehicle Center of Gravity	X(1).
			Maximum speed achieved on the slope.	Entity state PDU
FARV Mobility Criteria Tactical Mobility Longitudinal Close	Live Test	Travel up and down a 60%	Slope climbing capabilities with varying loads and associated centers of gravity.	X(1).
60% Maximum Slope Climbing Capability			Slope being climbed (in %)	Event report PDUs can report the terrain data carried locally in the host.
		5 mph forward velocity.	Weight of the vehicle. Maximum speed achieved on the slope.	Entity state PDU X(1).
FARV Mobility Criteria	Live Test	Maintain a	Average sustained uphill speeds for similar slope.	X(1).
Tactical Mobility Longitudinal Slope		downhill speed that is	Engine temperature at start and end of slope.	X(1).
Downhill Speeds Maintain downhill speeds not greater than		or less than	Time started down slope.	Event report PDU
up to 15%. See table below.		<u>.</u>	Time arrived at bottom of slope.	Event report PDU
2%65.0 kph 5%47.4 kph 10%32.0 kph 15%23.7 kph		the rakes hout ine ting.	Engine temperature at bottom of slope.	X(1).
FARV Mobility Criteria	Live Test	360 degree	Location of start of turn.	Entity state PDU
Pivot Steer 260 dames the chassis		completed	Periodic locations during the turn.	Entity state PDU
Job degree (ull) within 1.5 tilles are chassis			Location at the end of the turn.	Entity state PDU
		the vehicle	Trafficability in Cities.	*
		9	Mobility in Wooded and constricted terrain.	×

Subject of Experimentation/Testing: FARV Mobility Criteria.

Specifications	Environments for	Measures of	Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs
	Experimentation		Environment	(X = Insupportable by DIS PDUs)
FARV Mobility Criteria	Live Test	Vehicle	RCI for soil.	X(1).
Vehicle Cone Index (VCI)			Time vehicle entered soft soil area.	Event report PDUs can report the
soil.		becomes	Time vehicle departed the soft soil area.	terrain data carried tocatty in the host.
		with a RCI of	Minimum speed in the soft soil area.	Event report PDU
		0.04-	Did the vehicle stop?	Entity state PDU
			Trafficability and track footprint.	X(1).
			Wheel type and wheel base.	X(1).
			Automotive technology: Electrical or Conventional	X(1).
FARV Mobility Criteria	Live Test	Vehicle does	Speed of vehicle prior to beginning of braking.	X(1). Entity state PDU
Steering Drift		stop within	Location of vehicle at the beginning of braking.	X(1). Event report PDU
travel at full braking.		79.	Location of vehicle at the end of braking.	X(1). Entity state PDU
FARV Mobility Criteria Tactical Mobility	Live Test	Vehicle does or does not	Slope at the vehicle's location (in %)	Event report PDU
Start and Operate on all traversable slopes.		start on the	Time engine start initiated.	Entity state PDU
slopes.		slopes.	Time engine started.	Entity state PDU
FARV Mobility Criteria	Live Test	Vehicle does	Time engine began idling.	Entity state PDU
15 kg/hr at idle.		attain the	Time engine stopped idling.	Entity state PDU
		economy	Amount of fuel consumed during idling period	X(1).
		specified conditions.		
FARV Mobility Criteria	Live Test	Vehicle does	Time travel started.	Entity state PDU
Unrefueled Range		achieve the	Amount of fuel on-board at start.	Entity state PDU
Minimum acceptable range: 400 km at 47 kpn		specified range under the	Time travel ended.	Entity state PDU
		specified conditions.	Distance vehicle traveled.	Entity state PDU

Subject of Experimentation/Testing: FARV Mobility Criteria.

Specifications	Environments for Testing/	Measures of Performance	Characteriatics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Blements (X = Insupportable by DIS PDUs)
r minute	Live Test		Time refueling started. Time refueling ended. Total number of liters of fuel transferred.	Entity state PDU Entity state PDU Resupply received PDU
Refuel Rate Completely refueled within 2 minutes	Live Test	does not the I range ne ns.	Time refueling started. Time refueling ended. Total number of liters of fuel transferred.	Entity state PDU Entity state PDU Entity state PDU
stems	Virtual	ance ement	Vertical and lateral accelerations on crew and equipment with different type of track and suspension elements Vehicle speed. Obstacle height. Obstacle cross section. Vertical displacement of crew member's CG.	Event response PDU  Event response PDU
FARV Mobility Criteria Vehicle Mobility Subsystems Propulsion System	Virtual	Vehicle Performance Measurement s Vehicle performance with electric	Acceleration. Hill climbing capability Sustained speeds with different types of propulsion systems.	Entity state PDU. Entity state PDU X(1).

Subject of Experimentation/Testing: FARV Mobility Criteria.

Specifications	Environments for	Measures of	Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs
	Testing/ Experimentation	Performance	Collection if DIS Virtual Simulation is Appropriate	Required to Collect Data Elements (X = Insurancetable by DIS POLIS
FARV Mobility Criteria	Virtual	Vehicle does	Test vehicle systems that are electrically powered.	X(1).
Vehicle Mobility Subsystems		or does not		
Auxiliary Power Source		achieve the specified	Battery type sources.	X(I).
		operational	Fuel Cell Sources.	X(1).
		under the	Auxiliary Generator Sources.	X(1).
		conditions	Commercial Power Sources.	X(1).
		supplied	Provide/accept power to/from other vehicles.	X(1).
		different		
		operating conditions.		
FARV Mobility Criteria	Virtual	All critical	Vary power usage conditions.	×
		remain	Wattage required for full operation.	X(1).
		under all	Wattage required for each electrical component.	×
		abnormal operations.	Wattage capability of on-board primary and auxiliary X(1), power generation systems.	X(1).
			Wattage required for degraded operations.	×
			Determine time spent managing power and applicability of automation	X(1).
FARV Mobility Criteria Interior and Exterior Lighting.	Virtual	Is interior and exterior	Vary location and intensity of internal and external lighting.	×
		adequate for all operations	Collect data on crew performance of several different X(1), tasks while using each lighting configuration.	X(1).
		crew compartment configuration.	Collect data on security compromises under operational conditions with each lighting configuration.	Х(1).

Subject of Experimentation/Teating: FARV Mobility Criteria.

Specifications	Environments for	Measures of	Characteristics and Their Date Florents for	Bulestine Madified or New DIE PATE
	Testing/	Performance	Collection if DIS Virtual Simulation is Appropriate	Required to Collect Data Elements
	Experimentation		Environment	(X = Insupportable by DIS PDUs)
Upload of Fuel	Virtual	Can fuel be uploaded	Collect refueling rates for each of the following combinations:	X(1).
		normal and	Positive Pressure, Push Fuel;	×
		operating	Negative Pressure Pull Fuel;	×
		conditions.	Combination	×
Fuel Storage	Virtual	Can fuel be safely stored	Collect safety data and crew task loading, for each of the following combinations:	
		under all normal and	Positive Pressure, Push Fuel;	×
		abnormal operating	Negative Pressure Pull Fuel;	×
		conditions.	Combinations	×
Fuel Handling	Virtual	Can fuel be safely handled	Collect safety data and crew task loading, for each of the following combinations:	X(1).
		normal and	Positive Pressure, Push Fuel;	×
		operating	Negative Pressure, Pull Fuel;	×
		COTION TO THE	Combination	×
			Manual upload and download times.	X(1).
No Spillage	Live	Can fuel be transferred	Measure spillage, if any, while using the following fuel transfer processes:	X
		excessive	Positive Pressure, Push Fuel;	×
		age inde	Measure amount of fuel spilled.	×
			Negative Pressure Pull Fuel;	×
			Combination	×
			Manual processes.	_ ×

Subject of Experimentation/Testing: FARV Mobility Criteria.

Specifications	Environments for	Measures of	Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDU.
	Testing/ Experimentation	Performance	Collection if DIS Virtual Simulation is Appropriate Environment	Required to Collect Data Elements (X = Insupportable by DIS PDUs)
No Contamination	Live	Can fuel be transferred	Measure contamination, if any, while using the following fuel transfer processes:	×
		without contaminatio	Positive Pressure, Push Fuel;	×
		<u>.</u>	Negative Pressure Pull Fuel;	×
			Combinations	<b>×</b>
FARV Support and Transport Systems	Live	Can the FARV	Can the PARV Can the AFAS be attached to the FARV?	×
		temporary support to the AFAS when	Can the AFAS tow the FARV at the required speeds for the required distances?	×
		the AFAS is unable to do so itself.	Can the AFAS provide adequate auxiliary power to the FARV to enable the operation of all of the FARV communication systems, NBC protective systems, fuel and ammunition transfer systems and provide adequate power for its own systems.	×
Tool Sets	Live		Retrieve, assemble and use tool sets in different configurations and storage	X(I)
Rail Systems	Live		Ability to position the vehicle with different methods and degrees of visibility.	X(1)
			Time loading started.	X(1)
			Time vehicle in position for tie-down.	X(1)
Highway Freight Systems	Live		Ability to position the vehicle with different kinds and degrees of visibility	X(1)
			Time loading started.	X(1)
			Time vehicle in position for tie-down.	X(1)
Sea Transport Systems	Live	Can the vehicle be transported by sea transport.		

Subject of Experimentation/Testing: FARV Mobility Criteria.

Specifications	Environments for Testing/	Measures of Performance	Environments for Measures of Characteristics and Their Data Elements for Edating, Modified, or New DIS PDUs  Testing/ Performance Collection if DIS Virtual Simulation is Appropriate Required to Collect Data Elements  Experimentation (X = Insupportable by DIS PDUs)	Existing, Modified, or New DIS PDU. Required to Collect Data Elements (X = Insupportable by DIS PDUs)
AFAS Support and Transport Systems	Live		Ability to provide maintenance support to the AFAS X(1) and to be able to tow the AFAS to the maintenance facility.	, X(1)
Tool Sets	Live			
Towing Equipment	Live			

X(1). Note: DIS Simulation could provide an appropriate environment for testing and evaluation, however data on the DIS network would not generally support the measurements needed.

Technical and Operational Benefits of Vehicle Mobility Experimentation in DIS Virtual Environment. Subject of Experimentation/Testing: FARV Mobility.

Stated specifications. Based on the results derived from the above matrix, DIS experimentation appears feasible in assessing the operational and technical tradeoffs in the following FARV mobility specifications which in-turn support the requirement to keep up with the maneuver forces:

Must keep up with the maneuver forces.

- Maximum speeds for the vehicle.
- Sustained speed of 67 kph on hard surfaced roads
- 39 kph sustained speed cross country. 20 kph sustained speed, in reverse, over hard surfaced roads.
- Maintain minimum tactical speeds on uphill and downhill grades of 2% to 60%
  - Braking.

Minimum speeds for the vehicle.

- 4 kph Creep Speed Crew environment
- Maximum of 2.5 G road shock transmitted to crew.
- Maintain maximum speed on 25 mm root mean square terrain.
- Maintain a minimum speed of 64 kph over 38 mm root mean square terrain
- Maintain a minimum speed of 40 kph over 51 mm root mean square terrain.
  - At maximum speed, traversing a 310 mm half round obstacle.
    - At 16 kph, traversing a 410 mm half round obstacle.
      - **Terrain Mobility**
- Fording: Entrance and Exit Slopes of up to 40%. Climbing: 91 cm Vertical Obstacle in the Forward Direction.
- Gap crossing capability of 2.5 meters in the forward direction
  - 40% slope traversing capability.
  - 60% slope climbing capability
- 360 degree turn within a radius of 1.5 times the chassis length
  - Vehicle Mobility Subsystems:
    - **Track and Suspension.** 
      - Propulsion System.
- Auxiliary Power Source.
  - Power Management.
    - Upload of Fuel
- Other Aspects of Performance Measurable in a DIS Virtual Environment. The sub-elements listed under paragraph 2.1 can be assessed individually 7.7
- outputs. The transmission emulation accepts the power output of the engine, subtracts applicable losses and provides the resultant power to the final drives. The final drives accept resistance, slope, obstacles, etc. from a terrain file and provides amount power output, excess power available, thermal efficiency, engine temperature, fuel consumption rates, etc. as the power output of the transmission, subtract losses and provide the resultant power to the sprocket, which turns the tracks and road wheels, and finally moves the vehicle. Soil characteristics, vehicle weight and other mechanical losses provide the rolling resistance. If the components are modeled in high fidelity, then the effects of each component can but Sustained speeds of at least 67 kph over hard surfaced roads. A set of integrated modules of simulated systems for the FARV must be developed to support this as well as other someplace like the Waterways Experiment Station (WES), U.S. Army Corps of Engineers, Geotechnical Laboratory, Analytical Studies Branch. If these modules are developed in they can be reused in other applications. In addition to the automotive system, a suspension system consisting of road wheels, torsion bars, springs, or other electro-mechanical shock absorbing devices. The simulated engine accepts throttle position from the crew cab; fuel type, ambient temperature, etc. from a attribute file; rolling tests. The set of modules must include an automotive system consisting of an engine, transmission, final drive unit, sprockets, tracks and track pads or a system consisting of determined and experimented with to provide the optimum mix of power and suspension that can still meet the criteria to maintain a minimum speed of 67 kph over hard engine, generator, electric traction motors, sprockets, tracks and track pads or hybrids containing components of either system. These modules may already exist, in a library
- Sustained speeds of at least 39 kph over level cross country terrain where the rolling resistance does not exceed 90 kg per tonne of vehicle weight. The model engine, transmission, final drives, sprockets, tracks, and track pads must be modeled, as described above.

### Subject of Experimentation/Testing: FARV Mobility.

- 3. Sustain 20 kph, in reverse, over hard surfaced roads. The main emphasis of this testing would be to determine what vision and steering devices that the crew/driver need to enable them to keep the vehicle on the road while sustaining the specified speed.
- 4. Vehicle Speeds. Maintain the minimum specified speeds, both in the uphill and the downhill direction. The emphasis of this testing would to determine the specifications for the engine, transmission and brakes that would be needed to satisfy the requirements as well as determine the overall impact on the requirement to keep up with the maneuver
- 5. Braking. Decelerate from maximum speed at an average rate of 5 m/s² at full combat weight. The emphasis of this testing would to determine the specifications for the engine, transmission and brakes that would be needed to satisfy the requirement.
- Vehicle Suspension. The vehicle suspension must safely carry the vehicle and its crew over terrain of specified roughness at least at the specified speeds without exceeding the vehicle or crew shock limits. The emphasis of the testing would be to determine if the suspension system for the vehicle and crew positions could perform as required for all combinations of vehicle weights, centers of gravity, tactical speeds, size and shapes of obstacles, etc.
- testing Creep Speed. Sustain a creep speed of 4 kph without engine overheat. Emphasis of this testing is to determine if the automotive system has enough excess cooling capacity to provide adequate cooling while moving at a much slower than normal pace for sustained periods of time. Conducting the experiment in a synthetic environment will allow under a wide range of environmental conditions.
- depth, is how the overhang of the gun tube and its associated pendulum effect, in conjunction with various entrance and exit bank slope configurations and suspension options will FARV Fording criteria. The vehicle must be able to ford streams. A major area of interest, other than the simple ability to drive through water that is at or below the specified affect the fording capability and its associated freedom of cross country movement. Will there be any combinations that cause the tube to drag or dig into the rear bank or slopes while still falling within the fording depth and entrance and exit slope criteria.
- cross gaps is dependent in part on the center of gravity and the vehicle suspension. Both parameters could be altered incrementally to observe the effects on the requirement each of 9. FARV Gap Crossing Criteria. The vehicle must be able to "self-bridge" small gaps of at least 2.5 meters width, at least while it is traveling in the forward direction. the variables has on all combinations of operational loads.
- overhang of the gun tube and its associated pendulum effect, in conjunction with various obstacle approach and departure slope configurations and suspension options will affect the capability to overcome obstacles and its associated freedom of cross country movement. Will there be any combinations that cause the tube to drag or dig into the rear bank or Vertical Step/Obstacles. The vehicle must be able to overcome vertical obstacles. A major area of interest, other than the simple ability to drive over an obstacle, is how slopes while still falling within the obstacle height and approach and departure slope criteria. 9
- combination of total vehicle weight, center of gravity, speed, and vehicle suspension. With accurate models, the virtual vehicle can try out different combinations of suspensions 11. Vehicle Cornering Ability. The vehicle must have the capability to make sharp turns at all operational speeds. The ability to accomplish these turns will depend on a and combat loads to determine if there will be any unexpected results, like loss of control or overturning.

#### 12. Slope Crossing and Climbing.

- a. Cross 40% slope. The vehicle must have the capability to traverse hard surfaced slopes of up to 40% at all operational speeds. The ability to accomplish traverse these slopes will depend on a combination of total vehicle weight, center of gravity, speed, and vehicle suspension. With accurate models, the virtual vehicle can try out different combinations of suspensions and combat loads to determine if there will be any unexpected results, like loss of control or overturning
- vehicle weight, center of gravity, suspension and automotive power system. With accurate models, the virtual vehicle can try out different combinations of suspensions and Climb and descend 60% slopes. The vehicle must have the ability to climb and descend slopes of up to 60%. The ability to climb and descend these slopes depends on total combat loads to determine if there will be any unexpected results, like loss of power or loss of forward motion.
- c. Start engine and operate on all slopes. The vehicle must have the ability to start engines on all slopes up to 60%, while facing whether the uphill or downhill. Wir accurate models, the virtual vehicle can try out different combinations of suspensions and combat loads to determine if there will be any unexpected results, like loss engine starting ability on certain slopes.
- pendulum effect, in conjunction with various tree densities and stem heights in forests, or city street widths and corners in built-up areas, will affect the maneuvering capability of the vehicle and its associated freedom of movement and choice of routes. What situations will cause the overhang of the main gun tube to be the limiting factor to movement? 13. Pivot Steer Clearance. An area of interest, other than the simple ability to turn the vehicle in a 360 degree, tight circle, is how the overhang of the gun tube and its associated

Subject of Experimentation/Testing: FARV Mobility.

14. Soft Soil Crossing Capability. With accurate models, the virtual vehicle can try out different combinations of vehicle centers of gravity, automotive power, suspensions and tracks at differing loads and speeds in synthetic operational environments to determine if there will be any unexpected results, like loss of traction or excessive scarring of the swil Soil and automotive models upon which to build the simulation may already exist at WES.

- Unrefueled Range. With accurate models, the virtual vehicle can try out different combinations of automotive power, suspensions and tracks at differing loads and speeds in synthetic operational environments to determine if there will be any unexpected results in fuel consumption, which in-turn will affect the range of the vehicle.
- rate) allow the vehicle to perform continuous operations for a 48 to 96 hours? Under what conditions, i.e. distances between resupply points, vehicle speeds, soil conditions, slupes, transfer the fuel at a rate that will completely refuel the vehicle in two minutes. In operational scenarios, will these two refueling requirements (a minimum rate and a maximum Refueling Rates. There are two requirements that must be tested. The first is the vehicle's ability to transfer fuel at a minimum rate of 132 liters per minute. The second is to number of resupply opportunities, etc. will the minimum or maximum refueling rates be insufficient to maintain the current operational pace.
- Different suspension models can be mated with chassis to determine if that particular design can meet the operational requirements by performing standard operational scenarios. Track and Suspension Subsystems.
- Propulsion System. Different propulsion system models can be mated with chassis and suspension to determine if that particular design can meet the operational requirements performing standard operational scenarios
- Auxiliary Power Sources. Different auxiliary power system models can be mated with chassis and suspension to determine if that particular design can meet the operational requirements by performing standard operational scenarios.
- 20. Power Management. Different auxiliary power system models can be employed with different vehicle systems architectures to determine the most useful methods of managing power within the vehicle. Experiment with a range of automation under operational conditions. Experiment with a wide range of possible power sources and their associated shart comings, i.e. commercial power and voltage sags and spikes, battery power and low voltage conditions, portable generator power and line noise, etc. Determine the impact of various power sources and their suitability on the accuracy, safety, and reliability of vehicle systems.
- Interior and Exterior Lighting. Use the simulator and/or a virtual vehicle to determine the best locations and types of external and internal lighting. Employ the vehicle in the synthetic environment to defermine the operational impacts of having or not having lighting.
- FARV to meet that one requirement. The ability of the FARV to keep up with the maneuver force can be evaluated in the DIS environment. Each of the supporting enablers can be varied in-Sample Experiment. The key requirement in the above specifications is for the FARV to keep up with maneuver forces. Most of the other requirements are enablers that allow the turn to examine its effect on the ability of the FARV to keep up with the maneuver force. First, create an FARV full size, functional crew cab and a mathematical model that can represent the experiment is to determine if the FARV can respond to all requests for fires, conduct rearm as required under all conceivable weather conditions and still maintain the same relative distance from the maneuver forces as it was at the beginning of the scenario, regardless of terrain and number of fire missions received. rest of the FARV and its systems. Place the FARV in a DIS combat scenario. Run the scenario, and monitor the position of the FARV in relation to the maneuver force. The objective of the
- 1. Place the crew in the crew cab of the FARV simulator.
- Place the simulator inside the DES environment.
- Execute a series of standard scenarios, with the primary variable being the speed of advance of the maneuver force.
- Have the crew "drive" the FARV through the synthetic environment, moving as directed by HHQ and responding to calls for fire.
- Collect data to determine the difference in the distance between the maneuver force and the location of the FAS each time the FARV receives a call for fire.
- Make the air temperature hotter or colder and see if the automotive system can handle it. Vary the synthetic environment and redo the tests using the same scenario.
- 7. Vary the automotive components, the fuel, the rearm times, etc. and see what effects the changes have on the ability of the FARV to keep up with the maneuver unit.
- 3. Required Resources. To support experimentation and testing in the areas identified above, the following resources are required:
- 1. One FARV crew to man an FARV simulator crew cab.

- Subject of Experimentation/Testing: FARV Mobility.
  2. One PARV crew compartment and associated simulator interfaces, equipped with BCC, radios, modems, crew stations, crew displays, supporting software, with access to M712. Copperhead rounds in the ammunition storage area
- 3. One FARV emulation system to stimulate the crew interfaces in the simulator and provide, either directly or indirectly, vehicle performance data to the DIS environment. The requirements for the emulator(s) are discussed in more detail in paragraph 4, below.
- 4. A target acquisition system and fire control to acquire targets and submit calls for fire to engage targets on the virtual battlefield.
- 5. One fire direction computer operator
- 6. One AFATDS POC computer to process the observer's call for fire during centralized FARV operations, automatically relay calls for fire during decentralized uperations, and update FARV information base on fire support coordination measures and battlefield geometry, meteorological data, and preplanned targets.
- 7. One FARV SAFOR to support senior to subordinate FARV operations
- 8. Threat SAFOR operations order
- 9. Threat SAFOR to execute the order
- 10. Friendly force operations order with fire support coordination measures and battlefield geometry
- Friendly SAFOR to execute the order
- Emulators Required. The following models or emulations will be needed to support the FARV simulator. ÷
- Primary automotive emulation packages consisting of models representing an engine/generator and transmission/electric drive unit and final drives/sprockets.
- Primary chassis and suspension emulation packages consisting of models representing springs/torsion bars, road wheels, tracks and track pads.
- Chassis model (in software) consisting of chassis, turret, gun tube, crew cab, etc. Primary interest in the DIS testing is in the chassis-gun tube configuration.
- 4. Auxiliary power system consisting of primary and auxiliary generator, storage batteries, auxiliary hydraulic pump, auxiliary fuel pump, auxiliary propellant pump, materials handling
- 5. Power management system consisting of appropriate power sources, and control devices. Some of the devices may be crew accessible inside the simulator and will require a high fidelity emulation.

Subject of Experimentation/Testing: AFAS Auxiliary Power

1. Data Collection Requirements

Specifications	Environments for Testing/ Experimentation	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified or New DIS PDUs Required to Collect Data Elements (X=Unsupportable by DIS PDUs)
External Power. The system shall be capable of accepting military and commercial power at worldwide U.S. military facilities for the purpose of conducting training and	Live	Total quantity of main engine fuel consumed, with and without external power		
maintenance activities. These activities shall include starting in main engine, running diagnostic routines, downloading ammunition and supporting embedded training functions.		Comparative percentage of engine down time, with and without external power		
	Virtual or Live	Total quantity of main engine fuel consumed per hour, with and without auxiliary power	Quantity of fuel on board at time "t"	Data PDU
collective protection system, or moving the vehicle) for a period of time no less than 6 hours. If this capability is provided external to		Comparative percentage of engine down time, with and without auxiliary nower	Main engine status at time "t"	Entity state PDU
the main engine, it shall be capable of starting the main engine. The system shall be able to			Full operational status (y/n) at time "t"	Event report PDU
transition from this mode to full operational status within 45 seconds.			time transition to full operational status started	Event report PDU

Subject of Experimentation/Testing: AFAS Auxiliary Power

- 2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment. The benefits of this kind of experimentation are limited to providing a small input to a bruade evaluation of the system fuel consumption, maintenance and resupply requirements.
  - 3. Required Resources. DIS PDUs to capture fuel consumption and maintenance down time.

Subject of Experimentation/Testing: FARV Auxiliary Power

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Specifications	Environments for	Measures of Performance	Characteristics and	Existing, Modified or New DIS PDUs
•	Testing/		Their Data Elements	Required to Collect Data Elements
	Experimentation		for Collection if DIS Virtual Simulation is	(X=Unsupportable by DIS PDUs)
			Appropriate Environment	
External Power. The system shall be capable of Live	live	Total quantity of main engine fuel		
accepting military and commercial power at		consumed, with and without external		
worldwide U.S. military facilities for the		power		
purpose of conducting training and				
maintenance activities. These activities shall		Comparative percentage of engine down		
include starting the main engine, running		time, with and without external power		
diagnostic routines, downloading ammunition		•		
and supporting embedded training functions.				
Reduced power mode. The system shall be	Virtual or Live	Total quantity of main engine fuel	Quantity of fuel on	Data PDU
capable of supporting all functions (less firing		consumed, with and without auxiliary	board at time "t"	
the primary armament, operating the NBC		power		
collective protection system, or moving the			Main engine status at	Entity state PDU
vehicle) for a period of time no less than 6		Comparative percentage of engine down	time "t"	•
hours. If this capability is provided external to		time, with and without auxiliary power		
the main engine, it shall be capable of starting		•	Full operational status	Event report PDU
the main engine. The system shall be able to			(y/n) at time "t"	•
transition from this mode to full operational			Time transition to full	
status within 45 seconds.			operational status	Event report PDU
			started	•

# Subject of Experimentation/Testing: FARV Auxiliary Power

- 2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment. The benefits of this kind of experimentation are limited to providing a small input to a bruader evaluation of the system fuel consumption and resupply requirements.

  3. Required Resources. DIS PDUs to capture fuel consumption and maintenance down time.

Subject of Experimentation/Testing: AFAS Interoperability

1. Data Collection Requirements

	Testine/	Performance	Collection of DIS Virtual Simulation is	Collect Data Riemonts
	Experimentation		Appropriate Environment	(X = Unsupportable by DIS PDUs)
	Live or Virtual		Capability	
use Single Channel Ground and Airborne				
Radio System (SINCGARS) AN/VRC-92A			Record of digital message traffic over SINCGARS	Transmitter, Receiver and Signal PDUs
(long range receiver/transmitters (R/T)			radios	
combat net radio for voice and data			Record of voice communications over	Transmitter, Receiver and Signal PDUs
communications. One R/T will be dedicated			SINCGARS radios	
to voice and the other to data		-		
communications.				
Message Compatibility. All messages shall be Live or Virtual	Live or Virtual		Accuracy	
compatible with the Advanced Field				
Artillery Tactical Data System (AFATDS)		Percent of	Number of AFAS messages by type transmitted	Transmitter, Receiver and Signal PDUs
using protocols specified in MIL-STD 188-		errors in	to AFATDS configured systems	)
200/V/M and FATDS Version 10.		AFATDS	Number of AFAS messages by type received to	Transmitter, Receiver and Signal PDUs
		messages	AFATDS configured systems	
		)	Record of AFATDS message errors	Transmitter, Receiver and Signal PDUs
		Percent of	Number of AFAS messages by type transmitted	Transmitter, Receiver and Signal PDUs
		errors in	to FATDS configured systems	
		FATDS	Number of AFAS messages by type received to	Transmitter, Receiver and Signal PDUs
В		messages	FATDS configured systems	
~ 2			Record of FATDS message errors	Transmitter, Receiver and Signal PDUs

Subject of Experimentation/Testing: AFAS Interoperability

Specifications		Environments for Testing/	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Elements  (X = Unsupportable by DIS PDUs)
FARV Interoperability. The AFAS is supported by the FARV which provides for	AFAS is	Live or Virtual		Capability	
automated fuel and ammunition resupply and manual resupply of other consumables	ion resupply			Record of dockings between FARV and AFAS Record of Internesshilty problems	Event Report PDU x
				Record of manual resupply items requested by	Signal PDU
				Record of manual resupply items delivered by FARV	Signal PDU
			Percent of successful dockings	Number of dockings and transfers attempted Number of dockings and transfers successfully completed	Event Report PDU  Event Report PDU
				Accuracy	
			Percent accuracy of fuel exchange	Quantity of fuel requested by AFAS Quantity of fuel delivered by FARV	Signal or Event Report PDU Signal or Event Report PDU
B - 284			Percent accuracy of LP propellant exchange	Quantity of LP propellant requested by AFAS Quantity of LP propellant delivered by FARV	Signal or Event Report PDU Signal or Event Report PDU
•••			Percent accuracy of ammunitio n exchange	Quantity of ammunition requested by AFAS Quantity of ammunition delivered by FARV	Signal or Event Report PDU Signal or Event Report PDU
			Percent accuracy of resupply data exchange	Number of fuzed projectiles by lot, fuze, type and weight transferred by sending system Number of fuzed projectiles by lot, fuze, type and weight accepted by receiving system	Signal PDU Event Report PDU
DIS Interoperability. The evetor will include a network interface	anchanta James	Live or SIL		Capability	
Simulation (DIS) protocols and standards.	Interactive d standards.		Percent accurate PDUs generated	Record of DIS PDU generated without error Record of DIS PDUs generated	All PDUs generated can be captured via dataloggers for analysis.
The interface shall consist of a DIS Cell Interface Unit (CIU) or a DIS Cell Adapter Unit (CAU) as defined by the DIS Architecture Description Document.	DIS Cell Cell Adapter DIS ument:			Record of operations with conducted DIS CAU Record of operations conducted with DIS CIU	

Subject of Experimentation/Testing: AFAS Interoperability

Specifications	Environments for Testing/	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is	Existing, Modified, or New DIS PDUs Required to Collect Data Elements
	Experimentation		Appropriate Environment	(X = Unsupportable by DIS PDUs)
ve a	Live or Virtual		Capability	
physical interface with the FAKV. The				
interface shall include a power interface, an			Record of fuel transfers completed through	Signal PDU
ammunition transfer interface, a fuel			docking interface	
transfer interface, and a communications			Record of voice and digital communications	Signal PDU
interface.			conducted through the docking interface	
			Record of ammunition transfers conducted through the docking interface	Signal PDU
Intervehicle C3. The C3 system shall be	Live or Virtual		Capability	
interoperable with FARV to execute its			•	
intended mission.			Record of digital communications between	Signal PDU
			vehicles when docked	
			Record of voice communications between	Signal PDU
			vehicles when docked	
Fuel Interoperability. The AFAS shall be	Live or Virtual		Capability	
capable of being manually refueled from				
standard Army on-vehicle fuel containers			Record of manual fuel transfer operations	×
and from standard Army refueling vehicles.			Type of refueling vehicle	×
The system shall also have a NATO standard	ï		Record of problems during refueling operations	×
מבן ווויבנומרבי זווב פאפרוון מומון עב			i	
COMPATIBLE WITH Standard Army Rerueling System (SARS).			Time	
28		Median	Time fuel transfer stopped	Event Report PDU
		Manual	Time fuel transfer started	Event Report PDU
		Fuel		•
		Transfer		
		1 me		

Subject of Experimentation/Testing: AFAS Interoperability

Specifications	Environments for Testing/ Experimentation	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing. Modified, or New DIS PDUs Required to Collect Data Elements (X = Unsupportable by DIS PDUs)
Power Interoperability.	Live or Virtual		Capability	
Ine AFAS shall be capable of accepting military and commercial power at worldwide U.S. military facilities for the purpose of conducting training and maintenance activities including starting the main engine, running diagnostic routines, downloading ammunition and supporting embedded training functions.			Record of engine starts from external power Record of diagnostics run from external power Record of ammunition downloads operations conducted with external power Record of supporting embedded training operations conducted with external power Source of external power (Military, civilian, FARV, AFAS, etc.)	X (Generally, these data elements are not available in the normal DIS PDU stream. However, they could be made available through custom Event Report PDUs.)
The system shall be capable of accepting power from the FARV.			Capability  Record of engine starts where FARV provided external power  Record of diagnostics run where FARV provided external power  Record of ammunition downloads operations conducted where FARV provided	X (Generally, these data elements are not available in the normal DIS PDU stream. However, they could be made available through custom Event Report PDUs.)
The system shall be capable of being started			Capability	
With the standard INATO military power transfer slave cable (dwg 11682345, MIL-S-9 52131 and MIL-C-62122).			Record of engine starts with the standard NATO military power transfer slave cable	X (Generally, these data elements are not available in the normal DIS PDU stream. However, they could be made available through custom Event Report PDUs.)
Ground Transportability. The AFAS shall be	Live or Virtual		Capability	
transportable by military and commercial Heavy Equipment Transporters (HET).			Record of loading on a Heavy Equipment Transporters (HET)	×
			Type of HET (military or commercial) Problems encountered with HET loading	××
Air Transportability. The AFAS shall be air transportable by C-5 and C-17 aircraft in an	Live or Virtual		Capability	
operational configuration (non- sectionalized).			Record of loading on a USAF aircraft Type of aircraft (C-5 or C-17) Problems encountered with aircraft loading	×××
Rail Transportability. The AFAS shall be transportable by rail and comply with the	Live or Virtual		Capability	
NATO envelope B rail equipment			Record of loading on rail cars Type of car (US or NATO) Problems encountered with rail loading	***

Subject of Experimentation/Testing: AFAS Interoperability

	Testing/ Experimentation	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Elements (X = Unsupportable by DIS PDUs)
Sea Transportability. The AFAS shall be	Live or Virtual		Capability	
transportable by break bulk freighter,			Record of loading on a ship	<b>*</b>
off (RORO) vessels, lighter-aboard-ship			Type of ship (break bulk freighter, container	·×
(LASH), sea-barge (SEABEE) carrier and the			ships (as deck cargo), roll-on, roll-off (RORO)	
U.S. Army Tactical Watercraft Fleet (LARC-			vessels, lighter-aboard-ship (LASH), sea-barge	
LX and larger vessels) operating in sea state 7.			(SEABEE) carrier and the U.S. Army Tactical	
			Watercraft Fleet (LARC-LX and larger vessels))	
			Problems encountered with ship loading	×
			Sea state conditions (1 through 10)	×
	Virtual		Capability	
Automated Forces (SAF) implementation				
shall include battlefield entities required as a			Record of AFAS SAFOR	
result of adding AFAS to the electronic			Record of SAFOR encountered during exercises	
battlefield, including the AFAS system itself.			by the AFAS simulator or SAFOR	
			Record of PDUs received by AFAS  Record of PDUs each by the AFAS	
Digital Mapping Technology Interoperability. Live or Virtual	Live or Virtual		Capability	
The AFAS graphical display shall use digital				
map data bases available as standard products			Record of DMA digital map data bases used	
d from the Defense Mapping Agency and				
provide for:			Accuracy	
Circles for illefillediate crest creataine		Doggont	DAVA indicated interestinguish and a language	Post of Party of Part
- Vertical Interval - Iocation in northing, Easting and		rercent	Measured intermediate crest clearance	Event Report PDU
altitude		of crest		
- uses conventions of the Universal		clearance		
System		Percent	DMA indicated vertical interval	Event Report PDU
		agreement	Measured vertical interval	Event Report PDU
		of vertical		
		IIICI VAI		
		Percent	DMA indicated position (UTM Easting, Northing	Event Report PDU
		agreement of position	Moseumed monition (11TM Easting Northing and	Cincat Bonost DI
		nomisod to	Altitude)	even neport i DO
Iff Interoperability. The AFAS shall use	Live or Virtual		Capability	
System procedures and equipment to reduce			Record of BCIS use	Event Report PDU
the potential for fratricide.			Problems encountered with IFF identification	×

Subject of Experimentation/Testing: AFAS Interoperability

	5	Measures of	Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs Required to
	Experimentation	remormance	Collection if Dis vinual Simulation is Appropriate Environment	(X = Unsupportable by DIS PDUs)
Field Artillery Interoperability. The AFAS L	Live or Virtual		Completeness	
shall be capable of operating with other U.S.			•	
Army Field Artillery systems including:		Percent of	Number of messages received by the AFAS	Signal PDU
		incoming	Number of messages properly acknowledged	Signal PDU
- AN/TPQ-36 Radar		messages	(ACK)	ı
- AN/TPQ -37 Radar		translated	Number of messages not acknowledged (NAK)	Signal PDU
- MBC-23		without	Originator of message	ı
- FARV	-	error	•	
- AFAS		***		
- FIST DMD		Percent of	Number of messages sent by the system	Signal PDU
- DMD		outgoing	Number of messages properly acknowledged	Signal PDU
- Battery Computer System (BCS)		messages	(ACK) by the receiver	1
- Battalion Tactical Fire Direction System		translated	Number of messages not acknowledged (NAK)	Signal PDU
(BN TACFIRE)		without	by the receiver	•
- Brigade, Corps, Division Tactical Fire		error	Destination of message	Signal PDU
Direction System (BCD TACFIRE)			•	•

## Subject of Experimentation/Testing: AFAS Interoperability

operate with and be transported by a number of service assets validates its deployability and transportability. Operation with the software of other FA systems and vehicles, including the able to interoperate with other vehicle and systems on the battlefield to effectively and efficiently complete its mission. The system could be looked at for integration of various levels of compatibility of AFAS capabilities could be made. Selection and development of new or revised tactics, techniques and procedures could be pursued. Validation of the AFAS's ability to and key operational capabilities available to support and determine AFAS battlefield interoperability. The AFAS as a component of the "systems - the Field Artillery" must be FARV, demonstrates the system's ability to operate within the FA digital communications network. From the technical perspective, communicating to other systems demonstrates the 2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment. A DIS Virtual Environment would allow evaluation of the tactics, techniques and procedures automation, expert (decision aids) systems and controls/displays and their impact on the operational effectiveness on the battlefield. Assessment of the adequacy, maturity and AFAS system interfaces with those systems.

#### 2.1 Stated specifications:

- Communications
- Message Compatibility
- FARV Interoperability
- Intervehicle C3
- DIS Interoperability
- Fuel Interoperability Docking Interface
- Power Interoperability
- Ground Transportability
  - Air Transportability
- Rail Transportability Sea Transportability
- Semi Automated Forces (SAF)
- Digital Mapping Technology Interoperability IFF Interoperability
- Field Artillery Interoperability

# 2.2 Other Aspects of Performance Measurable in a DIS Virtual Environment. None

evaluate the overall impact on system and crew's capability to meet battlefield, system and transportability requirements. Placing the AFAS simulator on a combined arms virtual battlefield may not permit validations of some aspects as specified in the AFAS specification. However, the overall impact of design capabilities can be measured in terms of the battle outcomes at the conclusion of the experiment/scenario. Listed below are example battle statistics and conclusions that testers/analysts may derive from the data elements in the above system to the embarkation point and NATO B rail system from the debarkation point, and finally by ground transportation by HET to the forward area. This sequence of events could Sample Experiment. A single experiment/scenario in the DIS virtual environment can address each of the specifications and other aspects of performance outlined above. Command (TRADOC) scenarios appropriate to the AFAS System Threat Assessment Report (STAR) and at combat tempo in accordance with the approved Operational Mode Summary/Mission Profile (OMS/MP). For example if the scenario contains deployment to an overseas area, the AFAS could be shipped by aircraft or ship, transported on a US rail Analysts and testers can run the same experiment repeatedly altering or invoking system capabilities. The experiments should be run against approved Training and Doctrine matrix to correlate experiment results to design capabilities and/or changes:

- Median times of rearm/resupply/refuel operations
  - Average rate of rearm/resupply/refuel operations
- Accuracy of rearm/resupply/refuel operations, both manual and automated
  - Median Times required to conduct LRP Operations
- Compatibility with Ammunition types and sizes
  Demonstrated compatibility with AFATDS hardware and software
- Demonstrated compatibility with FATDS Version 10 hardware and software
  - Demonstrated compatibility with ATCCS common hardware and software
- Number of missions completed
- Number and type of rearm/resupply/refuel operations conducted

## Subject of Experimentation/Testing: AFAS Interoperability

- Number and types of projectile/fuze combinations resupplied
- Number and type of resupply operations conducted with Decision Aids
- Number and type of resupply operations conducted without Decision Aids
  - Accuracy and quantity of messages by type related to combat operations Communications net loading both digital and voice networks
- Operations conducted at the approved Operational Mode Summary/Mission Profile (OMS/MP) Number and type of manual rearm/resupply/refuel operations conducted
- 3. Required Resources. To support experimentation and testing in the areas identified above the following resources are required:
- One AFAS crew to man an AFAS simulator
- One AFAS simulator equipped with BCC, radios, modems, crew stations, crew displays, supporting software One FARV SAFOR to support AFAS to FARV resupply/rearm/refuel, communications and docking operations
  - One SAFOR PLS Truck to support LRP Operations
- One SAFOR fuel truck to support LRP refueling operations
  - A Time Ordered Events List (TOEL)
- ATCCS common hardware and software
- Various FA tactical systems and associated FATDS software for communications interoperability
- Various FA tactical systems and associated AFATDS software for communications interoperability

  Equipment to support transportability assessments (NATO B rail car, US rail car, HET (military), HET (commercial), C-5, C-17, break bulk freighter, container ships, roll-on, roll-of (RORO) vessels, lighter-aboard-ship (LASH), sea-barge (SEABEE) carrier and the U.S. Army Tactical Watercraft Fleet (LARC-LX and larger vessels)

Subject of Experimentation/Testing: FARV Interoperability

### 1. Data Collection Requirements

	Environments for Testing/ Experimentation	Measures of Performance	Characteriotics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New UIS FUUs Required to Collect Data Elements (X = Unsupportable by DIS PUUs)
Communications. The C3 Subsystem shall	Live or Virtual		Capability	
Radio System (SINCGARS) AN/VRC-92A			Record of digital message traffic over SINCGARS	Transmitter, Receiver and Signal PDUs
(long range receiver/transmitters (R/T)			radios	
combat net radio for voice and data communications. One R/T will be dedicated			Record of voice communications over SINCGARS radios	Transmitter, Receiver and Signal I'DUs
to voice and the other to data communications.				
Compatibility. All messages shall be	Live or Virtual		Accuracy	
compatible with the Advanced Field Artillery Tactical Data System (AFATDS).		Percent of	Number of AFAS messages by type transmitted	Transmitter, Receiver and Signal PDUs
,		errors in	to AFATDS configured systems	
		AFATDS	Number of AFAS messages by type received to	Transmitter, Receiver and Signal PDUs
		messages	AFAILD configured systems Record of AFATDS message errors	Transmitter, Receiver and Signal PDUs
		Percent of	Number of AFAS messages by type transmitted	Transmitter, Receiver and Signal PDUs
		errors in	to FATDS configured systems	Tennemittee Descrives on Circus 1971 L
		messages	FATDS configured systems	Hallshinger, Neveryer and Orginal FDOS
		•	Record of FATDS message errors	Transmitter, Receiver and Signal PDUs

Subject of Experimentation/Testing: FARV Interoperability

Specifications	Environments for	_	٦	Existing, Modified, or New DIS PDUs Required to
	Testing/ Experimentation	Performance	Collection if DIS Virtual Simulation is Appropriate Environment	Collect Data Elements (X = Unsupportable by DIS PDUs)
AFAS Interoperability. The AFAS is	Live or Virtual		Capability	
automated fuel and ammunition resupply			Record of dockings between FARV and AFAS	Event Report PDU
and manual resupply of other communications.			Record of manual resupply items requested by	Signal PDU
	****		Record of manual resupply items delivered by PARV	Signal PDU
		Percent of successful dockings	Number of dockings and transfers attempted Number of dockings and transfers successfully completed	Event Report PDU Event Report PDU
			Accuracy	
		Percent accuracy of fuel exchange	Quantity of fuel requested by AFAS Quantity of fuel delivered by FARV	Signal or Event Report PDU Signal or Event Report PDU
B - 292		Percent accuracy of LP propellant exchange	Quantity of LP propellant requested by AFAS Quantity of LP propellant delivered by FARV	Signal or Event Report PDU Signal or Event Report PDU
		Percent accuracy of ammunitio n exchange	Quantity of ammunition requested by AFAS Quantity of ammunition delivered by FARV	Signal or Event Report PDU Signal or Event Report PDU
		Percent accuracy of resupply data exchange	Number of fuzed projectiles by lot, fuze, type and weight transferred by sending system Number of fuzed projectiles by lot, fuze, type and weight accepted by receiving system	Signal PDU Event Report PDU
DIS Interoperability.  The system will include a network interface compatible with Distributive Interactive Simulation (DIS) protocols and standards.	Live or SIL	Percent accurate PDIIs	Capability Record of DIS PDU generated without error Record of DIS PDUs generated	All PDUs generated can be captured via dataloggers for analysis.
The interface shall consist of a DIS Cell Interface Unit (CIU) or a DIS Cell Adapter Unit (CAU) as defined by the DIS Architecture Description Document.		generated	Record of operations with conducted DIS CAU Record of operations conducted with DIS CIU	

Subject of Experimentation/Testing: FARV Interoperability

Specifications	Environments for	Measures of	Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs Required to
	Testing/	Performance	Collection if DIS Virtual Simulation is	Collect Data Elements
	Experimentation		Appropriate Environment	(X = Unsupportable by DIS PDUs)
_	Live or Virtual		Capability	
physical interface with AFASs. The interface				
shall include a power interface, an			Record of fuel transfers completed through	Signal PDU
ammunition transfer interface, a fuel			docking interface	•
transfer interface, and a communications			Record of voice and digital communications	Signal PDU
interface.			conducted through the docking interface	
			Record of ammunition transfers conducted	Signal PDU
			through the docking interface	
Intervehicle C3. The C3 system shall be	Live or Virtual		Capability	
interoperable with AFAS to execute its				
intended mission.			Record of digital communications between	Signal PDU
			vehicles when docked	
			Record of voice communications between	Signal PDU
			vehicles when docked	
Fuel Interoperability. The FARV shall be	Live or Virtual		Capability	
capable of being manually refueled from		•		
standard Army on-vehicle fuel containers			Record of manual fuel transfer operations	×
and from standard Army refueling vehicles.			Type of refueling vehicle	×
The system shall also have a NATO standard			Record of problems during refueling operations	· ×
fuel interface. The system shall be				
Compatible with Standard Army Refueling	-		Time	
29		Median	Time fuel transfer stopped	Event Report PDU
3		Manual	Time fuel transfer started	Event Report PDU
		Fuel		•
		Transfer		
		Time		

Subject of Experimentation/Teating: FARV Interoperability

Specifications	Environments for		Characteristics and Their Data Elements for	Existing, Modified, or New DIS PDUs Required to
	esting Experimentation	Lettormance	Appropriate Environment	(X = Unsupportable by DIS POUs)
	Live or Virtual		Capability	
The FARV shall be capable of accepting military and commercial power at wurldwide U.S. military facilities for the purpose of conducting training and maintenance activities including starting the main engine, running diagnostic routines, downloading ammunition and supporting embedded training functions.			Record of engine starts from external power Record of diagnostics run from external power Record of ammunition downloads operations conducted with external power Record of supporting embedded training operations conducted with external power Source of external power (Military, civilian,	X (Generally, these data elements are not available in the normal DIS PDU stream. However, they could be made available through custom Event Report PDUs.)
The system shall be capable of accepting power from the AFAS.			Capability	X (Conseally these data alements are not avail.
The system shall be capable of being started with the standard NATO military power transfer slave cable (dwg 11682345, MIL-S-52131 and MIL-C-62122).			Record of engine starts where AFAS provided external power Record of diagnostics run where AFAS provided external power Record of ammunition downloads operations conducted where AFAS provided external power	able in the normal DIS PDU stream. However, they could be made available through custom Event Report PDUs.)
R			Capability	
204			Record of engine starts with the standard NATO military power transfer slave cable	X (Generally, these data elements are not available in the normal DIS PDU stream. However, they could be made available through custom Event Report PDUs.)
Ground Transportability. The FARV shall be Live or Virtual	Live or Virtual		Capability	
Heavy Equipment Transporters (HET).			Record of loading on a Heavy Equipment	×
			Type of HET (military or commercial) Problems encountered with HET loading	××
Air Transportability. The FARV shall be air	Live or Virtual		Capability	
operational configuration (non-sectionalized).			Record of loading on a USAF aircraft Type of aircraft (C-5 or C-17) Problems encountered with aircraft loading	×××
Rail Transportability. The FARV shall be	Live or Virtual		Capability	
transportable by rail and comply with the NATO envelope B rail equipment			Record of loading on rail cars Type of car (US or NATO) Problems encountered with rail loading	×××

Subject of Experimentation/Testing: FARV Interoperability

L	1	7 7 7	177		Carlo Barre and Carlo Barre and Carlo
		Testing/			Collect Data Elements
		Experimentation		Appropriate Environment	(X = Unsupportable by DIS PDUs)
ŏ.	eq I	Live or Virtual		Capability	
5 8	transportable by break bulk freignter, container ships (as deck cargo), roll-on, roll-			Record of loading on a ship	*
<u>ਨ</u>	off (RORO) vessels, lighter-aboard-ship			Type of ship (break bulk freighter, container	×
<u>=:</u>	(LASH), sea-barge (SEABEE) carrier and the			ships (as deck cargo), roll-on, roll-off (RORO)	
<u>)</u>	U.S. Army Tactical Watercraft Fleet (LARC-			vessels, lighter-aboard-ship (LASH), sea-barge	
<u>د</u>	LX and larger vessels) operating in sea state 7.			Watercraft Blood (1 A DC. 1 V and Jarana succession)	
_				Participal rices (LANC-LA alla larger vessels))	>
_				Sea state conditions (1 through 10)	~ ×
įδ.	Semi-Automated Forces (SAF). Semi-	Virtual		Capability	
<u> </u>	ion				
TS.	shall include battlefield entities required as a			Record of FARV SAFOR	<del>- 10</del>
2	result of adding FARV to the electronic			Record of SAFOR encountered during exercises	
<u>ă.</u>	battlefield, including the FARV system itself.			by the FARV simulator or SAFOR	
				Record of PDUs received by FARV	
	-	, , , , ,		Action of LOS Sent by the PANY	
<u> </u>	Ungital Mapping Lechnology Interoperability. The FARV graphical display shall use digital	LIVE OF VITTURE		Capability	
· E	map data bases available as standard products			Record of DMA digital map data bases used	
B	col from the Defense Mapping Agency and			•	
<u>a.</u> - 2	provide for:			Accuracy	
95	- vertical interval		Percent	DMA indicated vertical interval	Event Report PDU
	- location in northing, Easting and		agreement	Measured vertical interval	Event Report PDU
re .	altitude	-	of vertical		
<u></u>	Transverse Mercator (UTM) coordinate		III CIAG		
8	system		Percent	DMA indicated position (UTM Easting, Northing	Event Report PDU
			of position	And Amitude) Measured position (UTM Easting, Northing and	Event report rDO
			•	Altitude)	
					Event Report PDU
					Event Report PDU
E	IFF Interoperability. The FARV shall use	Live or Virtual		Capability	
i ú	Standard battleneid Combat identification  System procedures and equipment to reduce			Record of BCIS use	Event Report PDI
) <del>=</del>	the potential for fratricide.			Problems encountered with IFF identification	×
J					

Subject of Experimentation/Testing: FARV Interoperability

	Environments for Testing/	Measures of Performance	Characteristics and Their Data Elements for Collection if DIS Virtual Simulation is Appropriate Environment	Existing, Modified, or New DIS PDUs Required to Collect Data Elements  (X = Unaupportable by DIS PDUs)
Field Artillery Interoperability. The FARV	Live or Virtual		Completeness	
shall be capable of operating with other U.S.			•	
Army Field Artillery systems including:		Percent of	Number of messages received by the FARV	Signal PDU
		incoming	Number of messages properly acknowledged	Signal PDU
- AN/TPO-36 Radar		messages	(ACK)	
- AN/TPO -37 Radar		translated	Number of messages not acknowledged (NAK)	Signal PDU
- MBC-23		without	Originator of message	
- FARV		error		
- AFAS				
FIST DMD		Percent of	Number of messages sent by the system	Signal PDU
- DMD		outgoing	Number of messages properly acknowledged	Signal PDU
- Battery Computer System (BCS)		messages	(ACK) by the receiver	
- Battalion Tactical Fire Direction System		translated	Number of messages not acknowledged (NAK)	Signal PDU
(BN TACFIRE)		without	by the receiver	
- Brigade, Corps, Division Tactical Fire		error	Destination of message	Signal PDU
Direction System (BCD TACFIRE)				

## Subject of Experimentation/Testing: FARV Interoperability

system's ability to operate within the FA digital communications network. From the technical perspective, communicating to other systems demonstrates the FARV system interfaces with thus 2. Technical and Operational Benefits of Experimentation in DIS Virtual Environment. A DIS Virtual Environment would allow evaluation of the factics, techniques and procedures and key interoperate with other vehicle and systems on the battlefield to effectively and efficiently complete its mission. The system could be looked at for integration of various levels of automation, capabilities could be made. Selection and development of new or revised tactics, techniques and procedures could be pursued. Validation of the FÁRV's ability to operate with and be transported by a number of service assets validates its deployability and transportability. Operation with the software of other FA systems and vehicles, including the AFAS, demonstrates the expert (decision aids) systems and controls/displays and their impact on the operational effectiveness on the battlefield. Assessment of the adequacy, maturity and compatibility of FARV operational capabilities available to support and determine FARV battlefield interoperability. The AFAS as a component of the "system of systems - the Field Artillery" must be able to

#### 2.1 Stated specifications:

- Communications
  - Compatibility
- AFAS Interoperability
- Intervehicle C3
- DIS Interoperability Docking Interface
- Fuel Interoperability

Power Interoperability

- Ground Transportability
  - Air Transportability
  - Rail Transportability Sea Transportability
- Semi Automated Forces (SAF)
- Digital Mapping Technology Interoperability IFF Interoperability
- Field Artillery Interoperability

### Other Aspects of Performance Measurable in a DIS Virtual Environment. None 7.7

appropriate to the FARV System Threat Assessment Report (STAR) and at combat tempo in accordance with the approved Operational Mode Summary/Mission Profile (OMS/MP). For example if the scenario contains deployment to an overseas area, the AFAS could be shipped by aircraft or ship, transported on a US rail system to the embarkation point and NATO B rail system from the wenter the same experiment repeatedly altering or invoking system capabilities. The experiments should be run against approved Training and Doctrine Command (TRADOC) wenarive debarkation point, and finally by ground transportation by HET to the forward area. This sequence of events could evaluate the overall impact on system and crew's capability to meet battlefield, transportability requirements. Placing the FARV simulator on a combined arms virtual battlefield may not permit validations of some aspects as specified in the FARV specification. Sample Experiment. A single experiment/scenario in the DIS virtual environment can address each of the specifications and other aspects of performance outlined above. Analysts and However, the overall impact of design capabilities can be measured in terms of the battle outcomes at the conclusion of the experiment/scenario. Listed below are example battle statistics and conclusions that testers/analysts may derive from the data elements in the above matrix to correlate experiment results to design capabilities and/or changes:

- Median times of rearm/resupply/refuel operations
- Average rate of rearm/resupply/refuel operations
- Accuracy of rearm/resupply/refuel operations, both manual and automated Median Times required to conduct LRP Operations
  - Compatibility with Ammunition types and sizes
- Demonstrated compatibility with FATDS Version 10 hardware and software Demonstrated compatibility with AFATDS hardware and software
  - Demonstrated compatibility with ATCCS common hardware and software
    - Number of missions completed
    - Number and type of rearm/resupply/refuel operations conducted
      - Number and types of projectile/fuze combinations resupplied

# Subject of Experimentation/Testing: FARV Interoperability

- Number and type of resupply operations conducted with Decision Aids
- Number and type of resupply operations conducted without Decision Aids

  - Accuracy and quantity of messages by type related to combat operations Communications net loading both digital and voice networks
- Number and type of manual rearm/resupply/refuel operations conducted
- Operations conducted at the approved Operational Mode Summary/Mission Profile (OMS/MP)
- 3. Required Resources. To support experimentation and testing in the areas identified above the following resources are required:
- One FARV crew to man an FARV simulator
- One FARV simulator equipped with BCC, radios, modems, crew stations, crew displays, supporting software
- One AFAS simulator equipped with BCC, radios, modems, crew stations, crew displays, supporting software to conduct fire missions One AFAS SAFOR to support AFAS to FARV resupply/rearm/refuel, communications and docking operations

  - One SAFOR PLS Truck to support LRP Operations
- One SAFOR fuel truck to support LRP refueling operations A Time Ordered Events List (TOEL)
  - ATCCS common hardware and software
- Various FA tactical systems and associated FATDS software for communications interoperability
- Various FA tactical systems and associated AFATDS software for communications interoperability

  Equipment to support transportability assessments (NATO B rail car, US rail car, HET (military), HET (commercial), C-5, C-17, break bulk freighter, container ships, roll-on, roll-of (RORO) vessels, lighter-aboard-ship (LASH), sea-barge (SEABEE) carrier and the U.S. Army Tactical Watercraft Fleet (LARC-LX and larger vessels)